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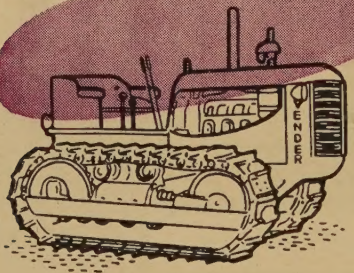

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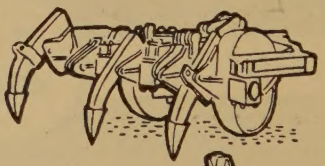

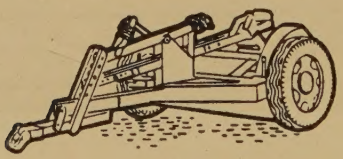

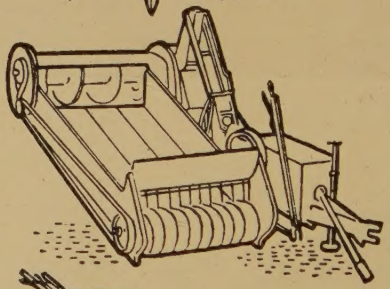

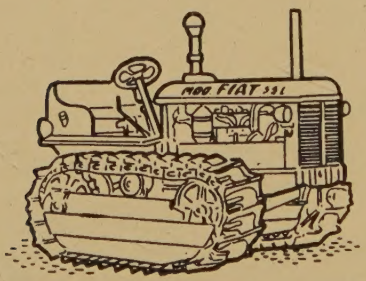

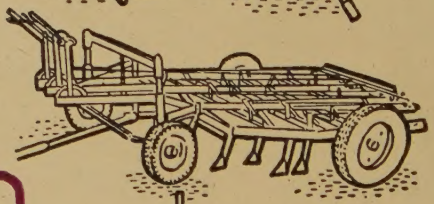

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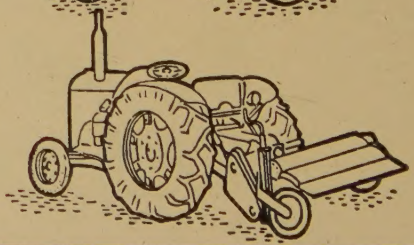

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WESTERN AUSTRALIA

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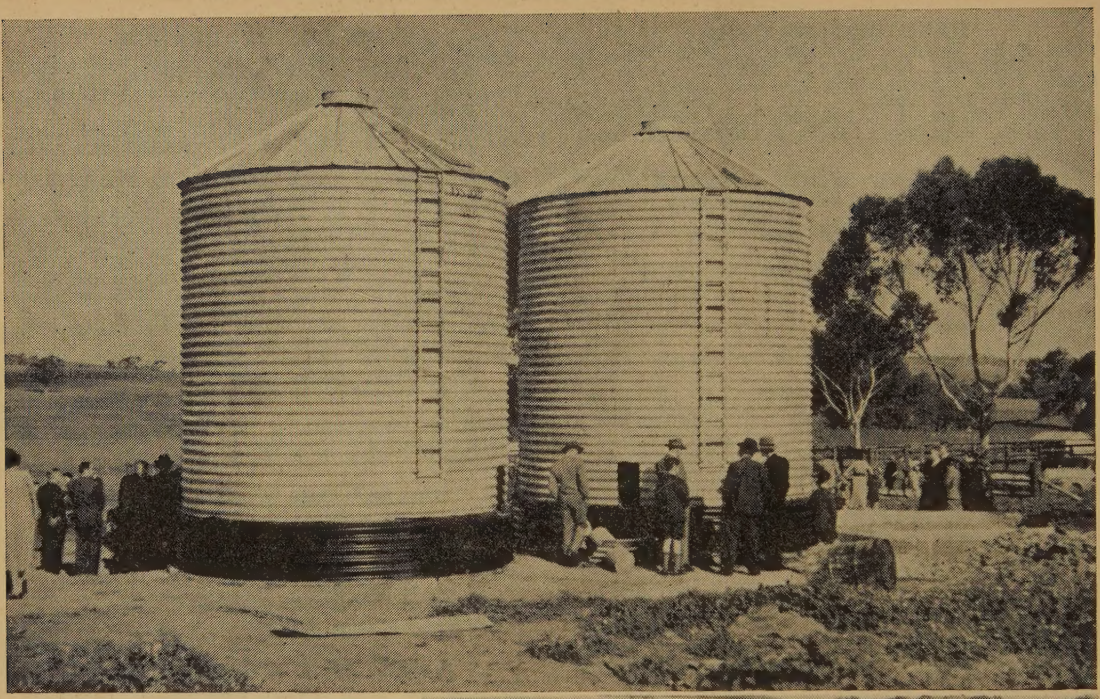
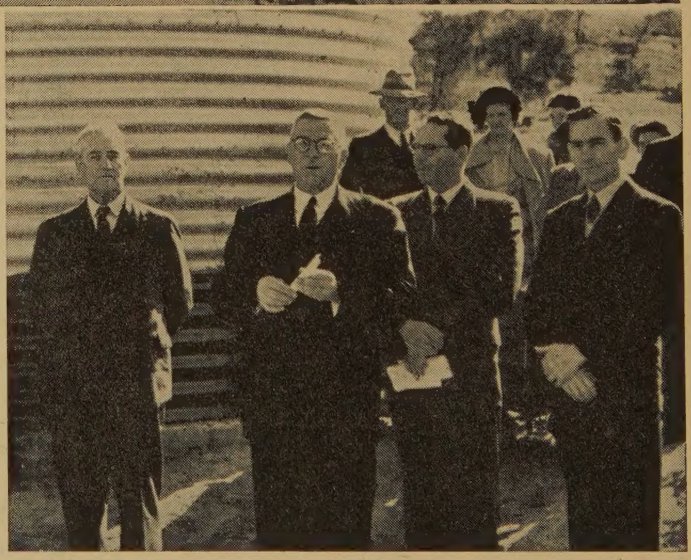


GRAIN SILOS FOR MURESK

On September 7, two grain silos, each with a capacity of 2,000 bushels were formally handed over to Muresk Agricultural College by representatives of the Trustees of the Wheat Pool of Western Australia.

The presentation was made to the Minister for Agriculture (Sir Charles Latham) by Messrs. W. J. Crosse and C. V. Honner, acting on behalf of the Trustees. Mr. Crosse said that the silos were provided for the use of the College as a loan for an indeterminate period. They were purchased with portion of the Pool Reserve Fund, built up over the years from small fractions of less than one-eighth of a penny remaining after the final pool payments were made.



Top picture shows the silos in position after erection by the students and staff of the College. The lower picture shows (left to right) the Minister for Agriculture (Sir Charles Latham); the Principal of Muresk (Mr. W. Southern); Mr. W. J. Crosse and Mr. C. V. Honner.

TEACHING CHICKENS TO PERCH

By R. H. MORRIS, B.Sc. (Agric.), Officer-in-Charge Poultry Branch.

Fig. 1.—This perching platform measuring 9ft. x 4ft. is used in a brooder compartment on one of the poultry "pilot" farms, and accommodates 150 chickens.

The platform consists of 2in. x 1in. boards spaced ¾in. apart. This platform is 9in. higher than the surface of the litter, and the ramp in the right foreground assists the 3½ to 4 week old chickens to climb on to the platform.

Note the sloping protective boards at the rear and side of the platform.

After seven to ten days on this platform, during which time infra-red globes are suspended 12in. to 14in. from the platform (height depends on voltage available), the chickens are transferred to their rearing quarters where the platform shown in Figure 2 is used until the chicks are nine weeks of age.

THE teaching of chickens to perch at a relatively early age is one of the most important managerial practices in the successful raising of healthy birds. Each year, many good chickens have their growth seriously retarded and in some cases are even trampled to death, by being permitted to remain on the floor until they are 10 or 12 weeks of age. Through faulty husbandry, some chickens, especially heavy breeds, never learn to perch and, as laying hens, camp on the ground in preference to perching.

Chickens that are allowed to camp on the litter after they are five weeks of age are apt to sweat, and smother one another. On reaching the age of five weeks, the chicks will migrate from the warm brooder, which is usually placed in the centre of the brooder compartment, to one particular wall or more frequently to a corner of the compartment and if left to their own devices will camp and crowd in the same spot night after night. In order to keep warm on a cold night, the biggest chickens being the strongest, are able to fight their way to the centre of the crowd, and it is these first-class specimens that perish. The group as a whole takes on a bedraggled appearance and should coccidiosis come along, as it very often does at this age, these conditions will considerably reduce the efficiency of the sulpha drugs (sulphamezathine or sulphaquinoxaline) which are normally used to cure this disease.

The teaching of chickens to perch, if not properly carried out, can be one of the most exasperating tasks experienced on a poultry farm. On the other hand, if a perching platform is used, the task is made relatively easy. A common but arduous method is to pick up each individual chicken and place it on the perch. The chicken responds by immediately jumping down on to the floor. The duration of the battle depends on the degree of persistency shown but frequently the farmer gives up, in despair, after two or three nights of fruitless endeavour, and yet another year's chickens suffer a severe check in their development.

THE PERCHING PLATFORM

To avoid such unsatisfactory occurrences and to promote even, rapid growth in the chickens, they should be taught to perch with the aid of a perching platform at four to five weeks of age.

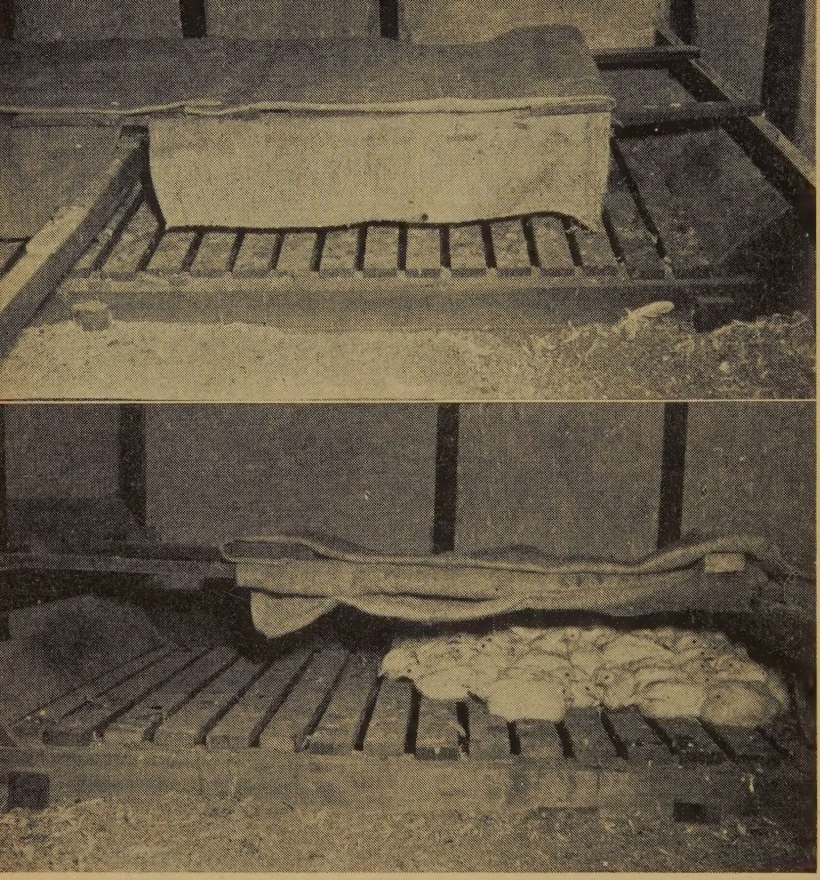


Fig. 2.—Batches of six-week-old chickens are snugly bedded down for the night behind the bagging curtain shown in the top picture. The bags, which form a cold brooder, are attached to the permanent perches installed 12in. above the platform. The bags forming the roof extend to within 18in. of the sides of the shed and 9in. of the back wall. The hanging curtain is 2in. to 3in. from the platform.

(Below) By lifting the front bag, one half of the chickens may be seen in position. Note how the chickens occupy the central portion of the platform. By appropriately arranging the bags, the chickens can be effectively discouraged from crowding into the corners of the platform or on to the back protective board.

Note the sloping protective boards at each side of the platform.

At seven weeks of age the top bags will be removed, and the front bags will be taken away a week later.

A wooden platform made of 2in. x 1in. battens placed flat, spaced ¾in. apart, and raised approximately 6in. from the ground should be placed along the back wall of the shed and the chickens should be driven on to this platform at dusk. The platform overcomes the troubles referred to above by providing a good body of air beneath and around the chickens throughout the night.

After driving the chickens on to the platform for about seven consecutive evenings at dusk, they will find their own way on to the platform and camp on it for two or three weeks until they are eight or nine weeks of age, when they will leave it of their own accord and fly up to the perches that are installed 12in. directly above the platform.

Normally, the brooder is used until the chicks are five weeks of age, and it is a good idea to acquaint the chickens with the platform when they reach the age of four weeks. This can be accomplished by installing a platform under the brooder when the chickens reach this age. Kerosene and electric hover brooders should be placed directly on the platform. Infra-red ray lamps, which are usually suspended in the centre of the brooder compartment can, on or about the 28th day, be swung across to the platform and suspended at a height of approximately 14 inches above it. A week later, that is when the chickens are 35 days old, the lights, and in fact any artificial warmth at all, can be dispensed with. Irrespective of how cold it becomes, the chicks will not come to any harm thereafter through chilling, providing they are bedded down on the platform each evening for the next two or three weeks, that is until such time as they take to the permanent perches.

KEEP CHICKENS AWAY FROM WALLS

Provision must be made to ensure that the chickens cannot get under the

platform and also that they cannot crowd on to the cold walls of the shed. In most rearing sheds, asbestos or iron is nailed to the outside of the studs, and if chickens are allowed to crowd on to such a cold surface as these materials provide during the winter months, heavy mortality can result through chillings.

A sloping 6in. x 1in. board running along the back and each side of the platform will be found effective in keeping the chickens away from the cold shed walls.

Fig. 3.—These 11-week-old chickens on one of the "pilot" farms were perching at the age of eight weeks. The good management and feeding that these birds have received is reflected in their even development.

All these birds were dewormed at ten weeks of age in keeping with Departmental recommendations, and have since been dewormed again at the age of 18 weeks.

The birds are an experimental batch of pullet chicks, hatched on May 1, 1952, and will be used to gain information on the advantages, if any, to be derived from farming very early hatched chickens, compared with first cross chickens hatched during June, July and August.

The bottom edge of the 6in. x 1in. protective board should rest on the platform at a point 4½in. from the wall of the shed and should be sloped away from the platform towards the side of the shed at an angle of approximately 45 degrees. This means that the top edge of the board rests on the outside wall.

The studs of the rearing shed which usually consist of 3in. x 2in. timber should be let into the board. If the studs are thicker than 3in., a wider board can be used. A 9in. x 1in. board is sometimes used and in this case the bottom edge of the board should be 6in. from the wall of the shed in order to maintain a satisfactory slope.

THE BAGGING CANOPY

Compared with vertical boards, sloping boards have two advantages. Firstly there is no possibility, when sloping boards are used, of the chickens getting down between the protective board and the side of the shed. Where vertical boards are used, special provision should be made to guard against this by fitting extra pieces of wood in the spaces between the studs. Secondly the two corners of the platform where each side protective board meets the rear protective board are not sharp. Consequently if chickens are forced into them they can easily extricate themselves. To encourage the chickens to camp on the platform when they are transferred to the rearing quarters at five weeks of age, wheat bags or similar material can be laid over the permanent perches for five or seven nights so forming a cold brooder, the roof of which is one foot above the platform. If the weather is warm, five nights are sufficient.

To encourage the chicks to camp in the centre of the platform and to provide sufficient ventilation, the bags should not extend over the full length of the platform. For instance, a platform 9ft. long would only require the

centre six feet covered over. Also the bags should only reach to within 9in. of the back wall of the shed.

At the time that the bags are placed across the permanent perches other bags should be hung from a perch which is in line with the front of the platform so that they hang to within 2in. of the platform. These bags will afford the chickens protection from the front of the shed and will encourage them to camp towards the front of the platform.

The bags that are draped along the front of the canopy can remain in that position for a fortnight. The chickens will then be seven weeks old and soon after these bags are removed the chicks should show signs of flying up on to the perches at dusk. Should one or two warm nights come along, this process will be considerably hastened. Prior to this time the chickens will have made use of the perches during the day.

When the chickens are brooded and taught to perch in the one shed, the same procedure as outlined above should be followed immediately the artificial heat is removed.

While on the platform the chickens will not suffer any ill effects through crowding, providing no more than 100 chicks are allowed to congregate together. If, for example, 150 chicks are running as a unit, it is advisable to subdivide the platform into two sections from the rear to the front. A length of 9in. x 1in. board placed on edge is suitable for the purpose. Approximately 75 chickens should be driven into each section at roosting time. A platform 9ft. long and 4ft. wide is sufficient for 150 chicks, and for consistently good rearing results, no more than 150 chickens should be reared as a unit.

The permanent perches should be spaced 18in. apart, and as the chickens grow and require more and more perching room, extra perches can be installed towards the front of the shed.

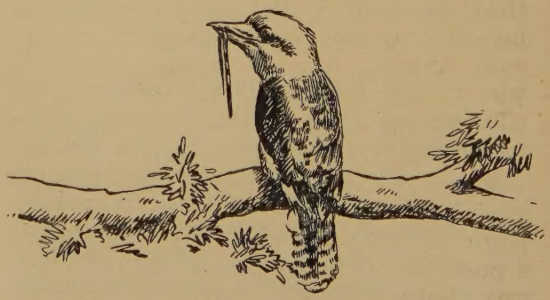
In addition to allowing enough room for a small dry mash feed trough, a rearing shed 12ft. x 12ft. will provide sufficient space for 150 chickens during the rearing period, that is from the time the chickens are five weeks of age until they are twenty weeks of age, at which time they should be transferred to the laying quarters. Do not be tempted to overcrowd chickens at any stage of their development.

By utilising a perching platform, the task of teaching chickens to perch automatically becomes an easy one. At the present time (1952 season) well-grown six week old pullets sell from 8s. to 8s. 6d. each, and one cannot afford to lose many pullets or retard their development by mismanagement at this important stage of their life. Far too many well-grown chickens are lost annually through being allowed to congregate in large numbers on the floor when they should be perching.

SUMMARY

When chickens are—

- 4 weeks old—Introduce them to a perching platform.
- 5 weeks old—Remove warm brooder, install perches and bags to form a cold brooder.
- 6 weeks old—Remove bags from top of cold brooder.
- 7 weeks old—Remove bags from front of cold brooder.
- 8 weeks old—Most of them should be perching.
- 9 weeks old—All should be perching. Remove perching platform. Provide extra perches as chicks develop.



FARM FENCING HINTS

3—STRAINING THE WIRES

By J. A. MALLETT

HAVING erected the posts and run the wires, the next task is that of straining the wires and—where barbed wires are used—tying them to the posts. Where wires have to be joined in the fence, the "figure eight knot," or "fencer's knot" as it is often called, is probably the best of all. It is easy to make, once one has mastered the knack, holds safely under strain, and may be pulled through a hole in a fence-post if the points are bent over.

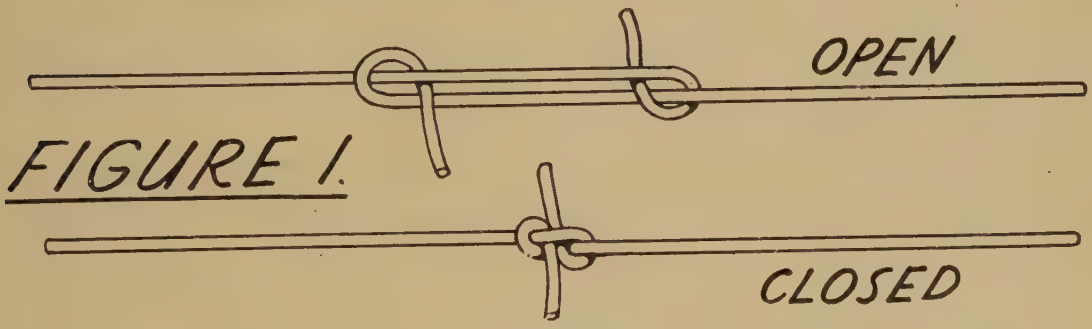


FIGURE 1.

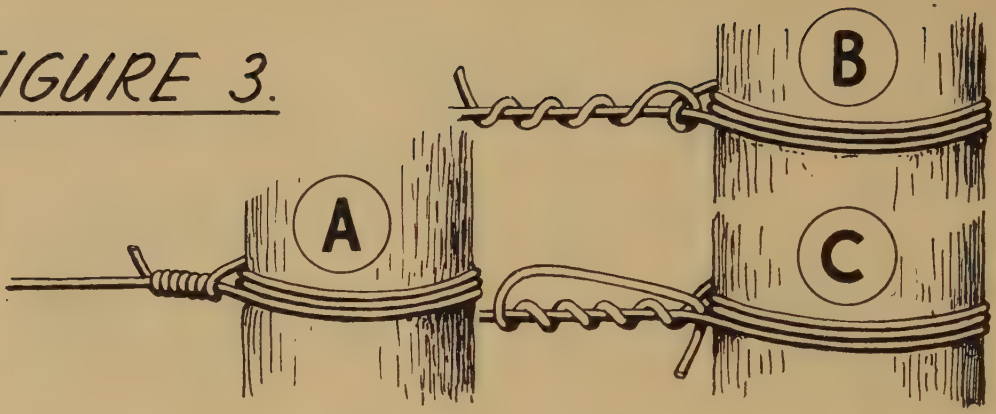
The diagram (Fig. 1) explains the knot more clearly than words. Note that when tied correctly the two ends lay side by side with one pointing upward and the other downward. Barbed wires may be joined with this knot if the end barb is removed from each wire to be joined.

When actually using the wire-strainers and joining two wires at the point of strain—as when straining from a position in the centre of a panel, midway between two strainer-posts—the double loop splice (Fig. 2) is deservedly popular for reasons which will become obvious later.

Straining may be carried out from the strainer-posts if desired, but the midway position is favoured for long strains as the tension is more evenly distributed along the panel.

FIGURE 2.

FIGURE 3.



Whichever method we decide to use, the wires will need to be secured to at lease one strainer-post. If we strain from the centre of the span they will be tied at each outer end.

Strainer posts are not usually bored, in fact this practice has little to recommend it, except that it facilitates the use of some types of wire-strainers. Mark your posts with the position of the wires, to give correct spacings, then take a couple of turns round the post and twist the wire round itself as shown in Fig. 3. It is handy to have a few feet of wire round the posts if breaks have to be repaired at some later date.

If you are using hard, brittle wire do not finish off the tie with a tight spiral as shown in Fig 3 (A). It looks neat, but is liable to snap under tension and is difficult to undo if repairs are to be carried out. Use a longer spiral or try one of the ideas shown in Fig. 3 (B) or (C).

STRAINING THE WIRES

There are many types of wire-strainer on the market, one of the most popular being the kind which has gripping jaws to hold the wires and a pivoting lever with two hooks which engage alternately in the links of a chain. This may be used in the centre of a span or, by

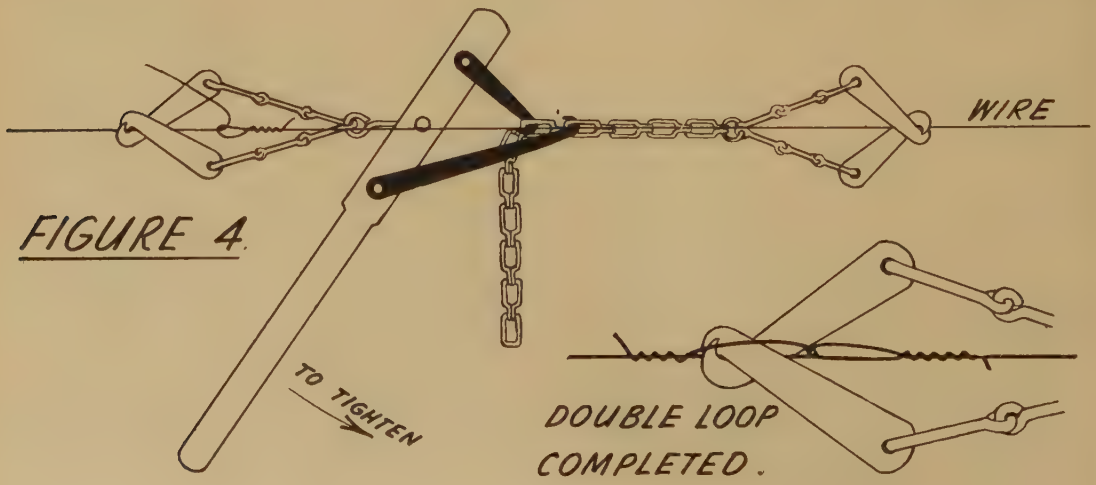


FIGURE 4.

the use of a loop or short length of wire, may be used close up to the strainer post.

If used in the centre of the span, one wire has a loop made in the end to give half the double loop splice shown in Fig. 2. The end of the other wire is passed through the loop and the strain is applied. When the wire is tight enough, the unlooped wire is pulled through the loop as far as it will go and then bent back on itself and twisted

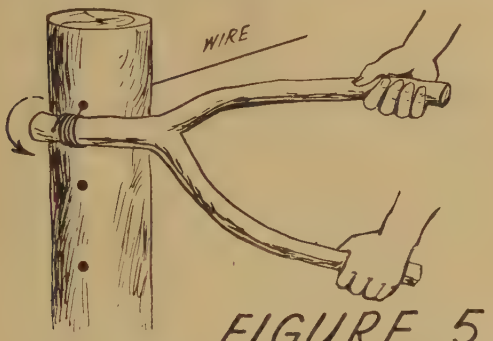


FIGURE 5.

to form the second loop around the gripping jaws of the wire-strainer as shown in Fig. 4. If desired, the double loop may be made away from the gripping jaws but the method described gives a tighter join.

For straining at the strainer-post, one pair of gripping jaws—those on the hook portion of the wire-strainers—are engaged on a short wire temporarily looped round the post. The jaws of the travelling, or chain portion of the wire-strainers are then engaged on the wire to be strained and when the required degree of tension has been achieved, the fence wire is taken round the strainer-post and secured.

FARM-MADE STRAINERS

Probably one of the earliest strainers ever used was a variation of the old "Spanish windlass" idea, the simplest form of which was a forked branch with a small hole bored through the butt end. The wire to be strained was slipped through the hole and bent over, then the fork was rotated, as shown in Fig. 5, causing the wire to tighten. In the diagram the strainer post is bored and, to complete the straining, a round punch is hammered into the hole jamming the wire tightly against the wood. Some of the wire is then unrolled quickly from the fork which is passed round the post and over the wire and the tie completed in the usual manner.

The fork may also be used to strain in the centre of a span employing the technique described for another home-made strainer shown in Fig. 6. This utilises the same windlass principle but is neater and more portable than the forked stick.

The outfit consists of a 12in. or 15in. length of $\frac{3}{4}$in. water-piping drilled with a $\frac{1}{8}$in. hole to take the wire and two $\frac{1}{2}$in. holes to take a length of round steel used as a tommy-bar. The bar is slightly tapered at one end and the other end may be turned over to form a loop for convenience in handling. An 8in. length of strap iron with a small hole near one end, makes a handy key for twisting and untwisting wires, and will save wear and tear on the fingers.

To use the strainer in the centre of a panel, first make a loop on the end of one wire. Try it the easy way by bending the wire back, putting the tommy-bar through the bight to hold it, then slipping the end of the wire through

FIGURE 6.

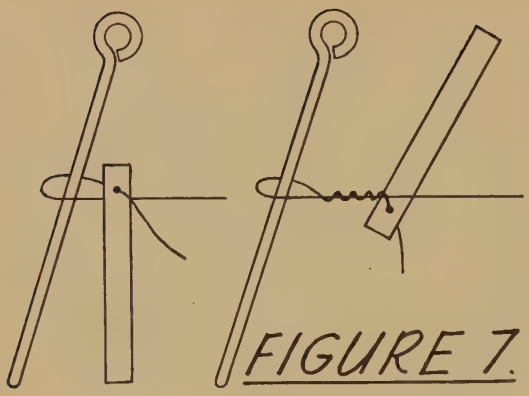


FIGURE 7.

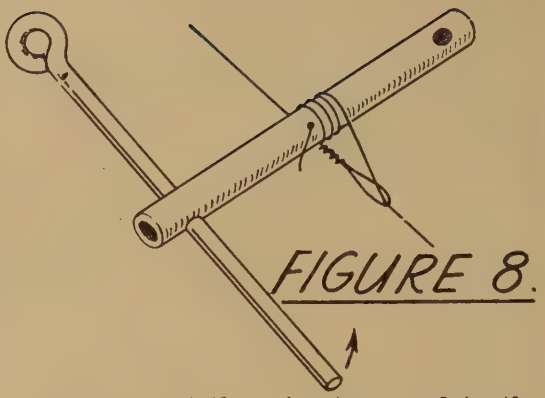


FIGURE 8.

the hole in the key as at Fig. 7. By simply rotating the key round the wire you can make a neat spiral of any desired degree of tightness.

Having made the loop, pass the end of the other wire through the loop and insert the wire in the small hole in the length of piping. Bend the wire over to hold it in position and then insert the tommy-bar in one of the large holes in the pipe and rotate the pipe so that the wire rolls up as on a windlass. (Fig. 8.)

Continue turning until the wire is taut, with the piping windlass hard up against the wire loop, then drag the piping back away from the loop so that the wire bends over to form a hook (Fig. 9). Slip your key or the tommy-bar through the hook and twist the piping round the wire to complete the double loop splice shown in Fig. 2.

For straining up to a bored post, the piping may be used in the manner described for the forked stick, but some farmers make a frame as shown in Fig. 10. The horizontal members of the frame are curved to fit snugly against the post and the piping is recessed into the side timbers and held there by two pieces of strap iron. Two tommy-bars may be used and, when the wire is sufficiently tight, one may be driven into the hole to jam the wire while the strainer is pulled away smartly from the post, allowing sufficient wire to unroll from the pipe to complete the tie.

When attaching wires to bored strainer posts, pass the first wire to the right round the post and the second to the left, alternating them so as to equalise the strain and lessen the tendency to twist the post in the ground.

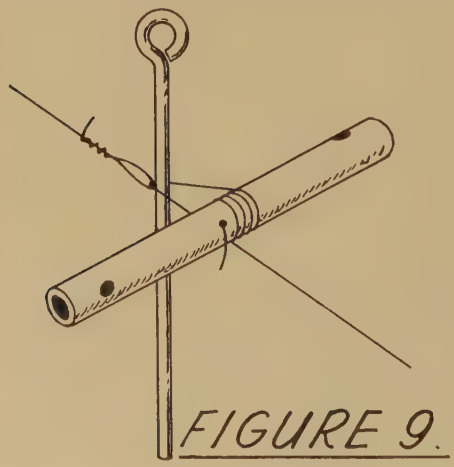


FIGURE 9.

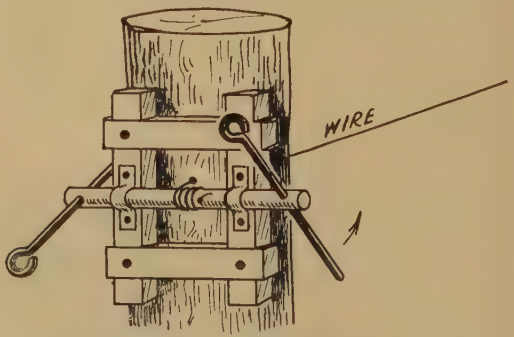


FIGURE 10.

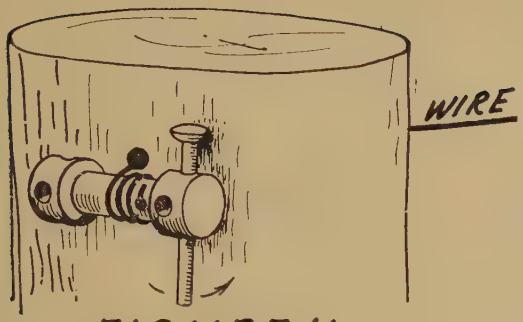


FIGURE 11.

The windlass principle is used in several types of factory-made wire-strainers and is perhaps best-known in the form of the permanent strainer shown in Fig. 11. This is a small cast metal "bobbin" about four inches long. The wire is slipped through the small hole and the bobbin is rotated by means of a tommy-bar until the wire is tight. A small bolt is then slipped through the hole to prevent the bobbin from unwinding and it is left in position on the fence, so that it can be tightened again when necessary. As one bobbin is needed for each length of wire, these permanent strainers would be rather costly on long fence-lines, but are useful for small enclosures.

BARBED WIRE

Most of the standard strainers may be used for tightening barbed wire, by simply joining a length of plain wire to the barbed and operating the strainer in the normal manner.

Barbed wire is tied to the fence-posts by short lengths of tie-wire. The usual method of tying, shown in Fig. 12 (A)

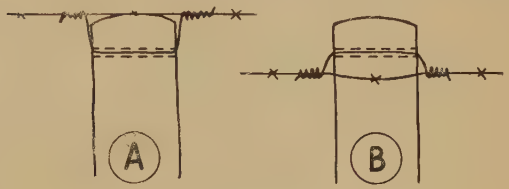


FIGURE 12.

is not particularly satisfactory as the wire is liable to slip off the posts and spoil the appearance of the fence as in Fig. 12 (B).

A neater finish is given by boring the top hole of the post at right angles to the fence-line instead of parallel to it

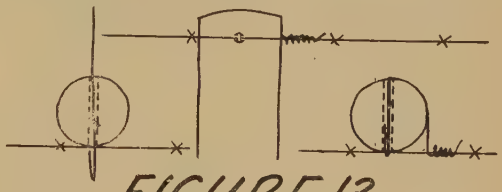


FIGURE 13.

as in Fig. 12. The wire is then tied with short lengths of wire, shaped staple-fashion, as shown in Fig. 13. Only the long end is twisted round the barbed wire.

(To be continued)

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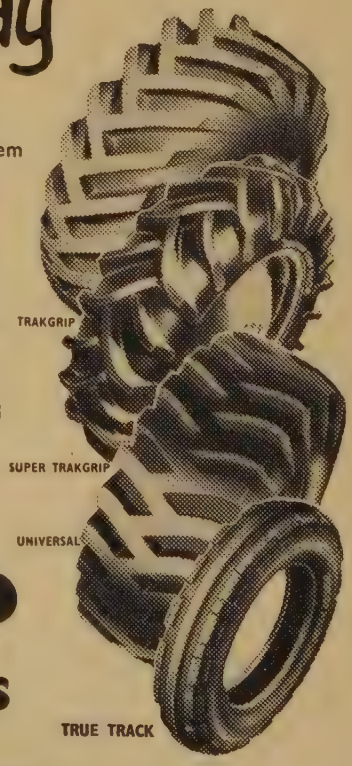

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TREE LUCERNE

A Fodder Crop Which Has Been Overlooked

By L. C. SNOOK, D.Sc., B.Sc. (Agric.), Animal Nutrition Officer

PERHAPS the greatest need in our agricultural areas is for a hardy legume which year after year will provide palatable green fodder during the late summer months. In the white-flowered Tree Lucerne (Cystisus prolifer) such a legume is available. Surprisingly enough, this hardy perennial shrub has never been exploited. Tree Lucerne is so hardy that self-seeded thickets can be seen growing on virgin land in the Darling Ranges and I have seen seedlings in the streets of Corrigin healthy and robust after six months without rain. The foliage is so palatable that cattle and horses will break down quite large trees and consume stems thick enough to be called limbs.

The foliage is of excellent feed value and has no poisonous properties. In composition, the leaves compare more than favourably with ordinary lucerne. In fact, young lush growth is more valuable per unit dry weight than is linseed meal.

Tree lucerne is a heavy seeder. Given protection from grazing stock a mother tree will soon be surrounded by thousands of seedlings. It is indeed surprising that such little use has been made of this admirable, self-perpetuating edible shrub. The only obvious disability is the need for some measure of protection from stock. But any worthwhile crop has to be protected by a fence. Is Tree Lucerne worth consideration as a crop?

When I was a student at the Narrogin School of Agriculture, the Principal, Mr. H. G. Shugg, planted Tree Lucerne extensively as hedges between double fences. These hedges were not only a source of beauty but they provided winter shelter and in the summer were cut systematically so that the fodder could be carted to the breeding ewes. These ewes and their lambs did particularly well, although the School farm is on poor country and subterranean clover was then unknown. It has always surprised me that some of the many farmers who admired both the hedges and the sheep have not followed up the demonstration. Surely there are ways of using these trees even in the absence of student labour to cut and cart the greenstuff.

When considering a crop, farmers are interested in yields per acre. In order to persuade farmers that Tree Lucerne is anything more than an ornamental novelty, it is necessary to show that the legume will give a return comparable to orthodox crops. I have endeavoured to estimate the fodder producing value of an acre of land planted with 100 trees, that is, on land carrying as many trees as in an ordinary orchard. Over three years I have made cuttings from trees growing in sand at South Perth and at Nedlands. The edible herbage was weighed and samples were analysed to determine water content and food value.

HEAVY YIELDS

The results of these studies have been tabulated in the appendix to this article. The high quality of the herbage and the increasingly heavy yields from the young trees indicate that Tree Lucerne merits serious consideration *as a crop.*

Plate 1.—Three-year-old Tree Lucernes showing recovery after being lopped for sheep feed. Photographed June 13, 1952, after being lopped on March 11, 1952. The trees are growing in deep sand at the Animal Health Laboratories, Nedlands.

The trees were about 2½ years old when the trial began. The cuttings made in October, 1949, and March and April, 1950, collectively yielded the equivalent of eight tons of edible greenstuff per acre of one hundred trees. This greenstuff is rich in everything the breeding ewe or milking cow requires, namely, protein, calcium, phosphorus and vitamins. As can be seen from the appendix, Tree Lucerne foliage is consistently nutritious, the composition being if anything better than ordinary lucerne at its best. Of more interest to wheatbelt farmers is the fact that herbage collected from Tree Lucerne at Beverley late in March of a dry summer was likewise highly nutritious. Just think how valuable such foliage would be if made available to breeding ewes in March and April of a year such as this.

In January and April of 1951 the trees were again cut for an estimated yield per acre of 13 tons of edible green herbage. The trees continued to respond well to the repeated lopping. (In 1952 the growth was too heavy to be conveniently cut and weighed.) As an indication of the rate of regrowth the tree shown in Plate 2 is worth study. This is growing in deep sand on high land at Nedlands. It was cut for sheep feed on March 21st. On June 24th it was again cut as shown in Plate 3. The material removed in the final cutting weighed 100 lb., of which 50 lb. (30% dry matter) was considered to be edible. One hundred such trees would have yielded about 2½ tons of this high class greenstuff. Most of the growth was made in three months of late summer and early autumn. The trees were given no water. As a point of interest some of the "inedible" stems were given to guinea pigs which stripped off the bark and ate deeply into the sapwood. Where the growth was kept young by regular cutting apparently there would be very little waste under wheatbelt conditions.

In considering these estimated yields of the fodder obtainable from Tree Lucerne it is well to reflect the probable returns which could be obtained from an equal area laid down to ordinary lucerne. Progressive farmers in the wheatbelt are now experimenting with trial plots of lucerne as the value of green leguminous herbage is well appreciated. It seems that similar trials with Tree Lucerne are equally justified. Both crops may require considerable effort to establish but whereas lucerne has a limited life on the best of the land, Tree Lucerne may become self-perpetuating on non-arable land. And as far as one can judge Tree Lucerne foliage is every bit as valuable as that from ordinary lucerne.

TREE LUCERNE FOR POULTRY

Poultry are very fond of Tree Lucerne leaves. When branches are thrown to hens or ducks the foliage is stripped with a zestful thoroughness which leaves no doubt about palatability. It is a worthwhile point that here is a green feed which can be fed without being chaffed. As the trees provide excellent shade and shelter it seems that poultry farmers would be well advised to grow Tree Lucerne as much as possible. The trees can be grown in the yards convenient for lopping, the birds will trim the foliage as high as they can jump and the smooth bark of the main stem will not provide harbour for vermin.

Plate 2.—A three-year-old tree which was lopped in March, 1952, and photographed June 27, 1952. It was then cut back as shown in Plate 3.

Plate 3.—Tree shown shown in Plate 2, after lopping in June, when 100 lb. green material was removed. Of this, 50 lb. was considered edible and yielded 15 lb. dry matter containing 25% crude protein.

Tree Lucerne sheds a heavy crop of seed each year. Birds are fond of this seed and one would expect these to be a useful supplement. The seeds have been analysed (see appendix) and have a composition akin to peas. Certainly it is no disadvantage to have this protein-rich "manna" falling into a poultry pen.

WHERE WILL TREE LUCERNE GROW?

Tree Lucerne thrives in a great variety of soils. It grows well on coastal sands although in the absence of fertilizer the trees may be short lived (five

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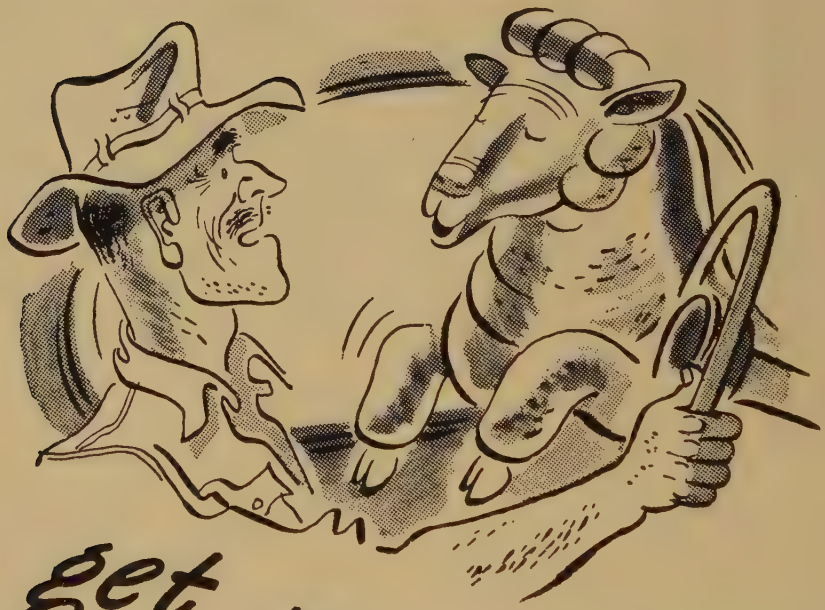

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Plate 4.—Tree after cutting in March, 1952.

years or so). In the Darling Ranges, Tree Lucerne has established itself in thickets on virgin bushland for example, clumps can be seen on the granite slopes at the top of Greenmount. In protected places robust trees can be seen as far east as Merredin and Corrigin.

Magnificent specimens of Tree Lucerne can be seen growing throughout the South-West. With fertilizer and regular cutting such trees would provide a heavy yield of palatable herbage for cattle, sheep, pigs or poultry. It would take many acres of early oats, for example, to return the same yield of nutrients as one hundred trees cut when feed is scarce in June.

HOW TO ESTABLISH TREE LUCERNE

Protection of the area from grazing animals is the prime essential. If alternative green feed is scarce, sheep and rabbits will eat through the bark well into the sapwood so killing even big trees.

Tree Lucerne can be established by planting out seedlings, which usually can be obtained in hundreds beneath old trees. Alternatively, before the winter rains, soil can be collected from beneath mature trees and this can be scattered in the new area, so that the seedlings can grow where desired.

For trial purposes a few "mother" trees could be planted in rocky areas or along creeks where the young plants could be protected by a rabbit-proof fence. If such mother trees flourish, a numerous crop of seedlings will appear in two or three years' time. Given protection, spreading will be automatic and rapid.

While the number of trees are limited it will be necessary to cut off the limbs and throw them to the stock.

When Tree Lucerne is well established, sheep could be admitted to trim all the lower branches, eat down any seedlings and enjoy the shelter provided. It is unlikely that tree trunks would be damaged while green foliage is made available by regular cutting of the higher limbs but the sheep would have to be removed as soon as bark chewing became obvious. Where the Tree Lucerne is encouraged to adopt the mallee form of growth (a number of stems from one root) it is much more difficult for sheep to kill a tree.

Tree Lucerne is most likely to be used to provide summer feed on land which cannot be cultivated. If the estimated yields of herbage are anywhere near the mark, however, this edible shrub could well be planted in strips on any large open area where it will flourish. Such strips would provide shelter for stock, counteract erosion, eliminate the need for vitamin supplements, and constitute a reserve of feed equal in bulk and exceeding in quality that provided by an oat crop yielding 150 bushels of grain per acre. Presumably Tree Lucerne will provide this bulk of green feed year after year.

FERTILIZER

Superphosphate is the main nutrient required. As with all legumes, Tree Lucerne responds well to liberal phosphatic dressings. Copper, of course, will be necessary where this element is lacking in the soil. The point to emphasise is that Tree Lucerne can only flourish if it is manured as would be any other productive crop.

NODULE PRODUCING BACTERIA

If seed is used to establish Tree Lucerne in new country the essential nitrogen fixing bacteria must be supplied by innoculation of the seed or the addition of soil from land growing robust trees.

Plate 5.—Same tree shown in Plate 4 photographed in June, 1952, showing autumn regrowth under natural rainfall at Nedlands.

DISEASES AND PESTS

The many trees I have observed during recent years have remained particularly healthy. Occasionally plagues of caterpillars have threatened to defoliate some trees but natural enemies soon seem to assert control. Tree Lucerne would seem to be a particularly "safe" crop under a wide variety of conditions, so long as by good management the shrub is enabled to make vigorous growth.

SUMMARY

It is suggested that Tree Lucerne *(Cystisus prolifera)* could be grown extensively to supply green fodder during the late summer.

This perennial shrub is hardy, relatively free from pests, grows on a wide variety of soils throughout the South-West of Australia, and is self-perpetuating if the seedlings receive protection.

The tree is ornamental, and provides excellent shade. It would counteract erosion if grown on stony outcrops and along creeks.

The foliage is of high food value, comparing more than favourable with ordinary lucerne. It is so palatable that the trees need some measure of protection from grazing animals.

It is estimated that land carrying an established stand of Tree Lucerne will yield a greater weight of edible fodder than any of the crops now grown in the wheatbelt. This fodder would provide protein, phosphorus and vitamins at present lacking in the diets of grazing animals under summer conditions.

Methods of establishing and utilising Tree Lucerne are discussed.

Acknowledgment: The chemical analyses reported in the appendixes were carried out by the Government Chemical Laboratories.

Appendix I.

TREE LUCERNE—COMPOSITION OF MATERIAL FROM TREES GROWING ON UNFERTILISED SOIL.

Composition as a percentage of dry matter.

Origin of Sample. The leaves and small edible stems were in all cases bulked for analyses.	Date Sampled.	Crude Protein.	Carbo-hydrate.	Crude Fat.	Crude Fibre.	Total Ash.	Calcium as Ca.	Phosphorus as P.
Narrogin School of Agriculture	25–10–48	21	54	3	17	5	1·05	0·16
Flowering bush growing on gravelly soil among native shrubs, Armadale	30–7–48	20	50	6	20	4	0·57	0·18
Merredin	17–12–48	18	58	4	14	6	1·12	0·17
Avondale Research Station, Beverley	20–5–50	20	52	4	19	5	0·83	0·12
COMPOSITION OF SOME OTHER FOODSTUFFS FOR COMPARISON.								
Average of six good quality mixed pastures from Margaret River area	Oct., 1948	22	44	4	22	8	1·00	0·32
Average of six good quality meadow hays from Margaret River area	Nov., 1947	13	49	2	28	8	0·90	0·19
Average four varieties oat grain, Beverley	1947	8	70	5	12	4	0·07	0·25
Average 36 samples oaten hay, Merredin	1944	5	59	2	28	6	0·06	0·12

Comments.—The high crude protein content of the Tree Lucerne herbage is of particular interest. It is only high quality pasture which can yield comparable figures. The relatively low crude fibre content is also important. The low phosphorus content is a reflection of the natural poverty of West Australian soils.

Appendix II.

TREE LUCERNE—COMPOSITION OF MATERIAL FROM TREES FERTILISED WITH SUPERPHOSPHATE.

Origin of Sample. The leaves and small edible stems were in all cases bulked for analyses.	Date Sampled.	Crude Protein.	Carbo-hydrate.	Crude Fat.	Crude Fibre.	Total Ash.	Calcium as Ca.	Phosphorus as P.
Clippings from two-year-old hedge, South Perth; sandy soil fertilised with superphosphate	23–5–48	25	47	3	18	7	1·65	0·30
Do. do. do.	30–7–48	31	39	6	18	6	1·08	0·41
Do. do. do.	11–10–48	28	47	3	16	6	0·93	0·38
Do. do. (three years old)	30–8–49	31	42	2	19	6	0·77	0·37
Clipped hedge, Muresk, 25 years old	30–8–48	27	44	3	20	6	0·75	0·30
Average winter growth	....	28	45	3	18	6	1·03	0·35
Same hedge as above	20–11–48	19	58	2	16	5	0·61	0·28
Do. do.	18–1–49	20	54	3	18	5	0·80	0·26
Second cutting from tree in second year, South Perth	5–3–50	17	50	3	25	5	1·06	0·21
First cutting from tree in second year, Nedlands	15–3–50	21	51	3	19	6	1·04	0·26
Average summer growth	....	20	53	3	19	5	0·90	0·25

Comments.—Vigorously growing Tree Lucerne yields dry matter which contains as much crude protein as linseed meal. Very few grazing crops can be grown with equal food value, judged in terms of actual composition. It will be noted that the use of superphosphate has in many cases doubled the phosphate content of the herbage grown. The low percentage of crude fibre is again noteworthy despite the inclusion of stems up to the thickness of a pencil.

Appendix III.

TREE LUCERNE—COMPOSITION OF THE SEED.

	AS A PERCENTAGE OF THE DRY MATTER.						
	Crude Protein.	Carbo-hydrate.	Crude Fat.	Crude Fibre.	Total Ash.	Ca	P.
Seed from fertilised hedge, South Perth. Collected December, 1948.	25	47	12	12	4	0·26	0·78
For Comparison—Field pea seeds	24	65	2	6	3	0·07	0·40

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SHEARING SHED DESIGN

By W. L. McGARRY, Sheep and Wool Adviser.

AS the returns from sales of wool represent a large proportion of many farmers' incomes at the present time, it is essential that the fullest consideration should be given to any factors affecting the lifting and preparation of the clip for market. Foremost among these is the provision of adequately-designed sheds with plenty of light and sufficient space for shearing and classing and for the wool tables, bins, press and other equipment.

A roomy, well-designed shed is essential if the shearing operations are to be carried out efficiently and expeditiously, and it is disconcerting to record that very few properties in the agricultural areas, possess sheds that meet these requirements.

On the majority of farms sheds are used for shearing and for the storage of grain and fertilisers. It will be found that, in most cases, some re-arrangement of the shearing board, bins, wool tables, etc., will minimise faulty work, lessen confusion and delay at shearing time, and enable the best use to be made of the available space and light.

SHEARING SHED DESIGN

There are many plans and designs of shearing sheds available to choose from and in the erection of shearing sheds the following points are well worth remembering:—

1. Shed space must be laid out economically to ensure the most efficient handling of sheep and wool, and in planning the wool room it is necessary to aim at a quick, clean, handling of the fleece with the wool travelling in the *one* direction towards the press.

2. It is a definite advantage to build the shed off the ground. Advantages with these types of sheds are—

(i) If the shed floor and adjoining ramp are built to the level of the floor of a motor truck, the labour involved in handling, storing, and loading of super, seed-wheat, wool, etc., is considerably reduced. Laborious lifting is avoided in this manner, and this applies particularly to periods during labour shortage and where large areas are to be topdressed or seeded quickly.

(ii) The space underneath can be used to house woolly sheep overnight and in the event of rain.

(iii) A shed built off the ground allows easy cleaning of the space under the sheep pens.

PLAN OF SHEARING SHED

1. A plan of a 4-stand fixed overhead gear, elevated shearing shed which is also very suitable for storage purposes is shown in Figs. 1 and 2. **This type of shed is definitely preferable to the type where the shearing board is on one side of the shed because it ensures more economical, efficient and easier handling of sheep and wool. This type of shed is recommended for any number up to eight of fixed overhead stands and also two-stand portable plants. The overall measurements, including the catching pens, can be reduced, increased, or modified, according to the number of stands, sheep space required, etc.** Do not be too economical with space when erecting a shearing/storage shed. The space will be required eventually.

2. In this type of shed the sheep do not have to be carried across the shearing board and the shearer does not have

GENERAL ARRANGEMENT OF 4-STAND OVERHEAD, ELEVATED SAWTOOTH ROOFED SHEARING SHED

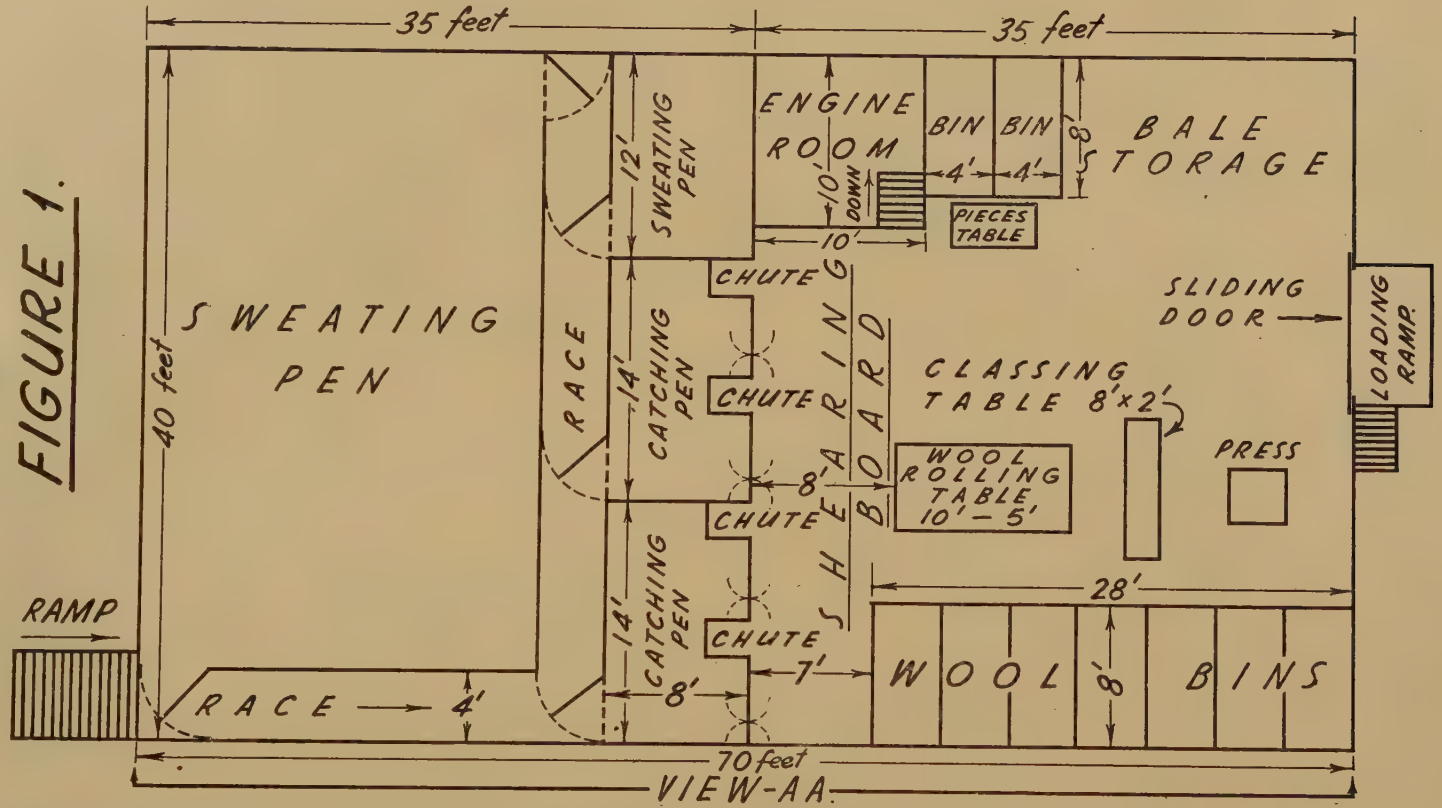

FIGURE 1.

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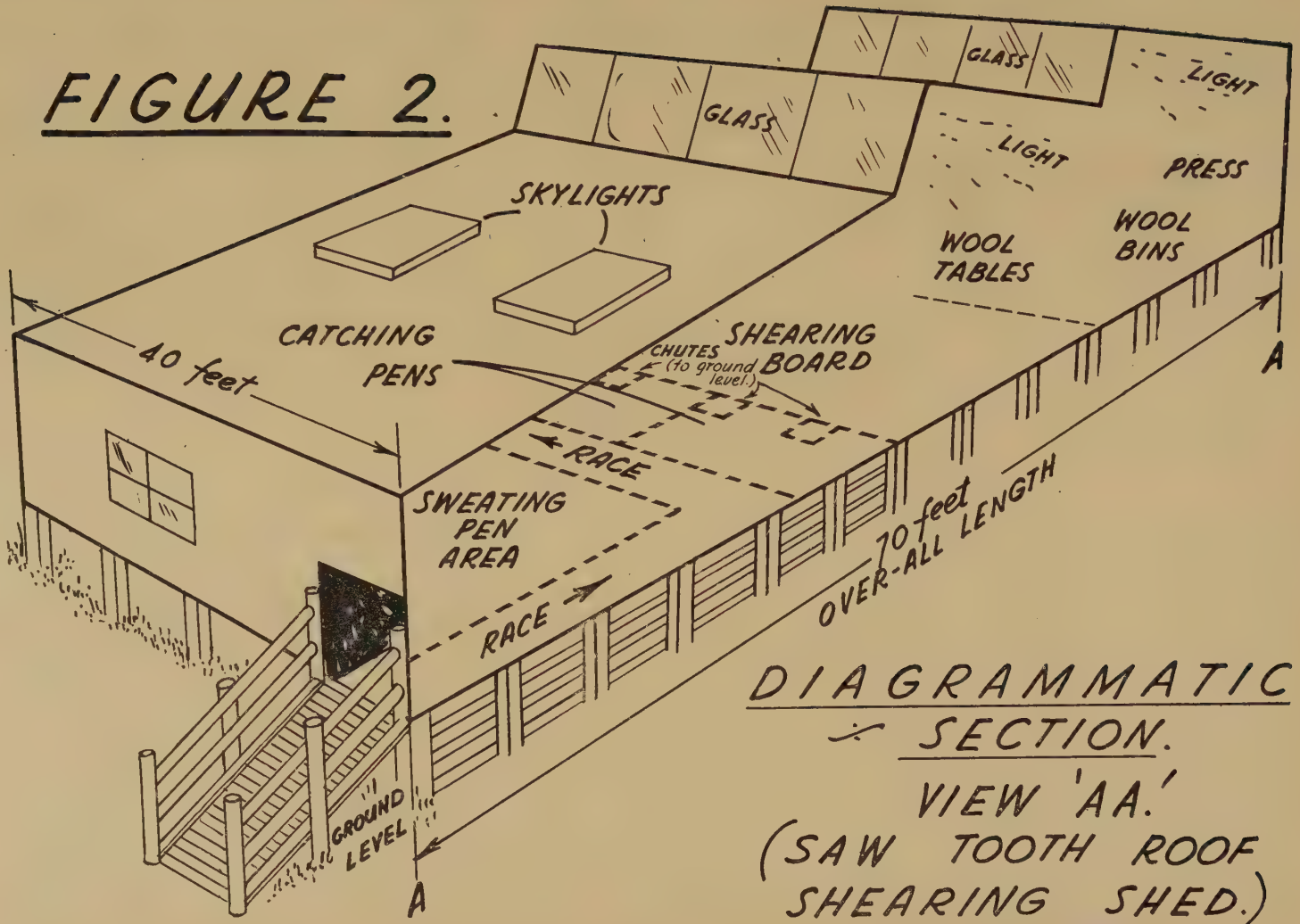
SPECIFICATIONS.—Capacity, 300 sheep allowing 4½ sq. ft. per sheep. Plan may be modified suitable for greater or lesser number of stands or for 2-stand portable plants. Floor to be built truck-height from ground. Bins to be of the movable type or hinged type swinging back against wall when not in use

FIGURE 2.



DIAGRAMMATIC SECTION.
VIEW 'AA.'
(SAW TOOTH ROOF SHEARING SHED.)

to step over the fleece to reach the catching pen. In addition the picker-up avoids excessive walking (or running) and saves time in handling the wool. By picking up the fleece and turning around, the wool can be thrown practically straight on to the wool-rolling table from the board.

3. The sheep will run and pen up easily in this type of shed provided there is plenty of light. **The advantage of the race as the sheep enter the shed and continuation of race adjoining the catching pens is obvious.**

4. A race under the catching pens and a chute connect the counting out pens with the board. The chute walls should be close boarded and it is not advisable to make the chute too steep.

5. The shearer enters the catching pen through a swing gate which is to the left of each machine (looking at the shearing board from the front), thus having the advantage of a complete backward pull when bringing the sheep out. This avoids any turning before commencing to shear.

6. With fixed overhead gear a *minimum* of 5ft. 2in. is necessary between shearing stands.

7. The use of frames or gate-type bins in type of shed shown in plan (see Fig. 1) results in considerable space being available for storage after shearing. During shearing in a shed of this type and size (70ft. x 40ft.) approximately 22 box-pressed bales could be stored, one bale high, in corner adjoining piece bins, without interference with work going on in wool room. Higher stacking would increase the storage proportionately.

LIGHTING

The question of light is particularly important in view of the fact that the bulk of shearing is done when days are short and often cloudy.

A good light is **essential** if the clip is to be classed to the best financial advantage and in addition a good light enables the classing to be carried out more quickly and easily. Very few shearing sheds in the farming areas are sufficiently well lighted to class wool properly, and the question of light seems to be one that is overlooked or ignored by many farmers when constructing their sheds, or when arranging their sheds in preparation for shearing. Farmers are not doing justice to either their clips or their pockets in preparing their wool for market in a poor light, and then subjecting it to the "acid test" of display and valuation under the excellent lighting of a wool showfloor.

Bad light also hampers the handling of the sheep in the shed and is certainly not conducive to good shearing. Sheep will move into lighted pens quicker and with less trouble than if the pens are in the semi-darkness, which is applicable to many sheds in the farming areas. When sheep are driven out of strong sunlight into a dark shed, trouble is experienced in getting them housed, and this is largely overcome when a shed is well illuminated with natural light.

Factors conducive towards improved lighting in existing sheds are:—

(1) Installation of saw-tooth type of roofs. (See Fig. 2.)

(2) Installation of skylights.

(3) Whitewashing of the inside walls and roofs of sheds. This will improve the lighting considerably at a small cost.

(4) Removal of a few sheets of iron where required and replacement with corrugated perspex, or similar transparent material. Be careful to avoid sun-glare however.

(5) Re-arrangement of pens, wool bins, wool tables and shearing board, so that the available light can be used to the best advantage.

(6) Replacing the galvanised iron or board sides of wool bins with wire netting or battens.

CATCHING PENS

Penning up can be made much easier if the side of the catching pen facing the shearing board is close boarded or covered to a height of about six feet. In this way the movement of the shearers and others working on the board is obscured and, as a result, the sheep will run much easier when being penned. **Except in the catching pens do not instal battens parallel with the direction in which the sheep are travelling.**

Removal of sheep from the catching pen is facilitated and leg injuries to sheep are minimised when the battens run parallel with the direction in which the sheep are being removed for shearing.

WOOL BINS

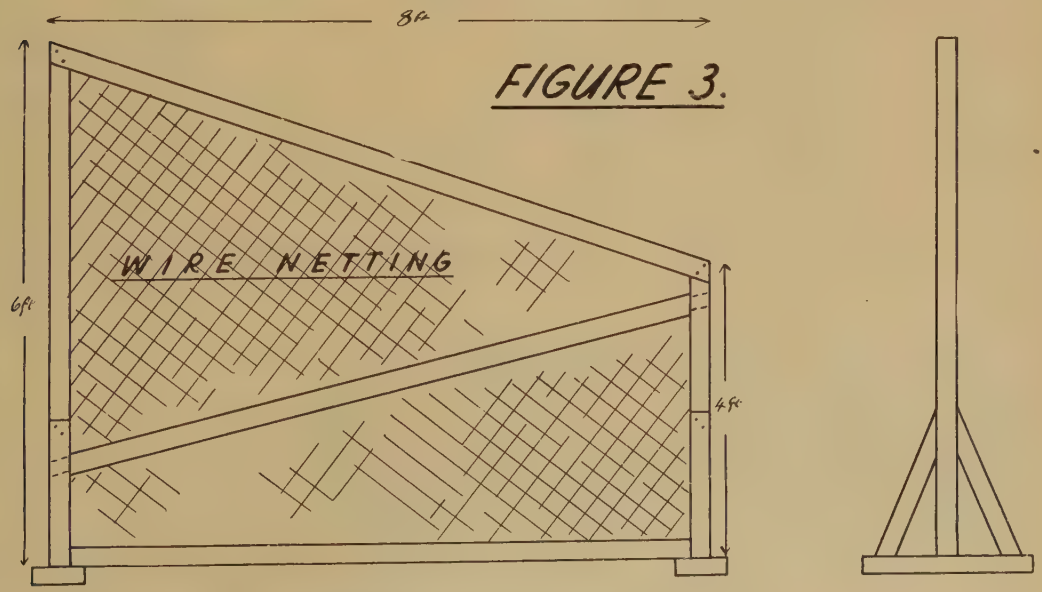
It is necessary to have at least *six* bins in the average farmer's flock of 1,000 to 1,500 sheep. In larger flocks more bins are necessary and in the rush of shearing more bins mean better classing, more convenience, less work and less double handling. One disadvantage of *fixed* bins is that they limit the space for storage after shearing. Another drawback is that these bins are generally made the same size, with the result that there is insufficient room for the main lines and too much for the other lines. Fixed bins are usually close boarded or made with galvanised iron sides and, as a result, are generally lacking in good illumination. Plenty of light should penetrate each bin to enable the classer to see that the various lines are kept uniform and to allow of the comparison of neighbouring lines of wool. It is an advantage to avoid placing wool bins against a wall if possible. If they are arranged so that the presser can obtain the wool from the back of the bin, this will give the presser, classer and other shed workers full freedom of movement without delaying or interfering with their work.

PORTABLE WOOL BINS

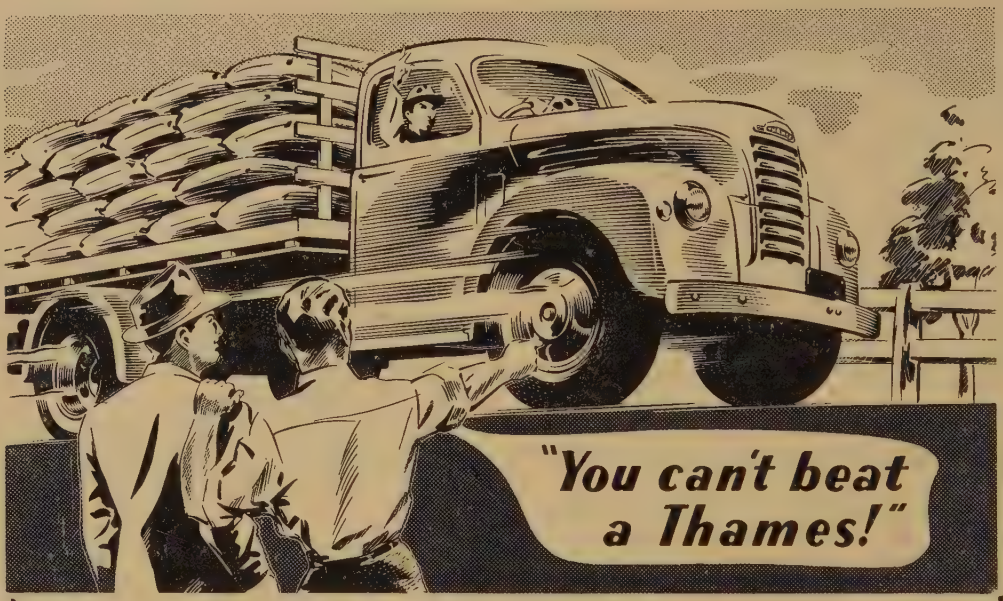
(Fig. 3)

The portable or frame type of wool bin is recommended and its advantages are:—

(1) After shearing these can be moved and this allows the use of the maximum storage space for super, grain, etc.



Movable frame used for for forming wool bins



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(2) Convenience in small sheds. Portable bins can be easily and quickly adjusted to any size required to accommodate the amount of wool going into various lines.

(3) Better light penetration to each bin.

(4) They can be moved or placed anywhere in the wool room during shearing.

Portable bins can be made of light timber (8ft. long and 6ft. high) in the form of frames, with the uprights fitting into "feet".

Front uprights—2in. x 2in. x 4ft.
Rear uprights—2in. x 2in. x 6ft.
Bottom cross pieces—2in. x 1½in. x 8ft.
Top cross pieces—2in. x 1½in. x 8ft. 6in.
Foot pieces—3in. x 2in. x 18in.

It is necessary to cover the frames with wire netting and this should be stretched tightly across the frame.

GATE-TYPE BINS

Bins made of light timber and affixed to the walls by hinges, gate fashion, are also very suitable. These can be swung back flush against the walls and out of the way after shearing and the whole bin space utilised for storage, etc.

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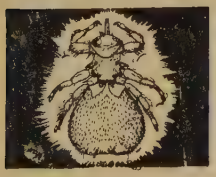

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FIRE HAZARD FORECASTS FOR FARMLANDS

New Weather Bureau Service

By J. HOGAN, Senior Forecasting Officer, Weather Bureau, Perth.

THE ever-increasing destruction by grass and forest fires during the summer months serves to emphasise the fact that many people are still showing considerable apathy towards this serious danger to property and life. In an effort to stimulate interest in fire prevention and control the Rural Bush Fire Prevention Advisory Committee, towards the end of last summer, convened a meeting to which representatives from the Forestry, Railways and Meteorological Departments were invited. The outcome of this meeting was that the Weather Bureau agreed to institute a fire hazard forecasting network to cover most of the agricultural areas in the South-West of the State.

Up to this time the fire hazard forecasts had been prepared only for the forest areas, and for 16 years co-operation between the Forestry Department, at Dwellingup, and the Weather Bureau has proved highly successful in the prevention and control of fires. The Forestry Department supplies the Weather Bureau twice daily with readings of pressure, temperature, humidity, etc., and at 3 p.m. each day, the maximum fire hazard for the day as assessed by the Forestry officials at Dwellingup is 'phoned to the Duty Forecaster.

This maximum fire hazard is calculated by the "stick" method, which derives its name from the use of a small cylindrical piece of oven-dried wood which is representative of medium-sized forest fuel. The "stick" is openly exposed near the ground and is weighed at regular intervals.

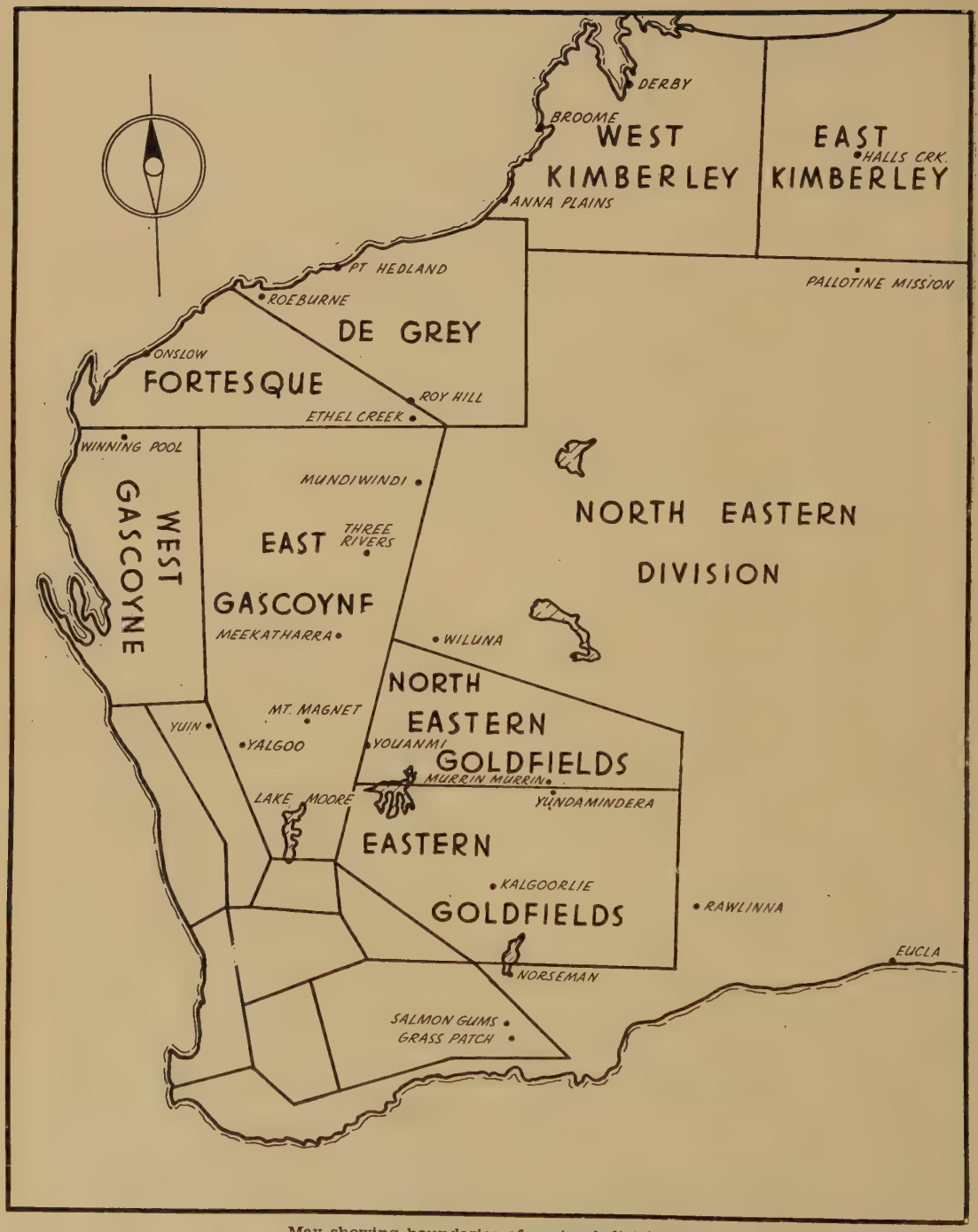
Variation in the weight of the "stick" gives an indication of the moisture change in the litter on the ground, and this is used as a basis for calculation of fire hazards. Temperature and humidity are the main factors regulating the weight of the "stick", increasing temperatures and decreasing humidities each tending towards higher hazards. The accurate forecasting of temperatures and humidity, therefore, plays an important part in the estimation of the hazard for the following day. In this respect consideration must be given to—

(a) the direction of wind—the backing of winds from east to north usually gives rise to higher temperatures;

(b) precipitation in the form of dew, drizzle or rain, each of which causes an increase in moisture in the grass or litter for extremely varied periods;

(c) the arrival of sea breezes or new air masses having increased moisture contents.

It will be noted that, so far, the strength of the wind has not been taken into account, the reason being that, in estimating the fire hazard, the degree of combustibility of the available fuel, whether grass, scrub or forest, is dependent mainly on temperatures and humidity. The chief function of the



May showing boundaries of pastoral districts.

wind is to pick up flaming debris and throw it ahead, and it becomes all-important once a fire has actually started. It also produces heating of fuel in advance of the fire by the laying over of flames, while the fire itself by its terrific up-draught increases the strength of the local wind at the fire.

A fire hazard and general weather forecast is issued daily at 4.15 p.m. to the Dwellingup Forestry Office during the summer months. On receipt of this information and with a knowledge of the forest condition during the day a fire hazard forecast is transmitted by radio to each of the various Divisional Fire Offices throughout the South-West of the State. These are located in the metropolitan area and at Mundaring, Jarrahdale, Harvey, Collie, Kirrup, Manjimup, Pemberton, Busselton and Margaret River.

The Divisional Officers in turn telephone the information to about 20 substations in the South-West and the 60 mobile field units are catered for by a special radio transmission from the Divisional Offices. Plans are drawn up for the next day's work and at 7.45 a.m. each day a special transmission from Dwellingup confirming or amending the previous day's forecast is transmitted to all stations, thus allowing the organisation to proceed as planned or be altered according to the forecast hazard.

HAZARDS CLASSIFIED

The minimum hazard is "low" summer and the range extends in increasing order of danger through "moderate, average, high, severe and dangerous." The hazard for any particular day is not only dependent on the conditions of temperature and humidity at the time but also on the cumulative effect of the condition on preceding days. A high temperature and low humidity on a day following rain will produce a hazard considerably lower than the same temperature and humidity on a day succeeding several hot and dry days.

A forecast of wind direction and force is issued with each fire hazard to enable the Forestry Department officials to take the necessary precautions should a fire break out. A fire burning with a N.E. wind develops a head fire moving towards the South-West. This is the most dangerous and rapidly moving section, and gangs and fire-fighting gear must be first concentrated to suppress this section.

The forecast of wind changes is also of the utmost importance to the fire fighter, and the arrival of a sea breeze will frequently change a comparatively quiet side fire into a new and dangerous head fire. If the firefighters are forewarned of the time of this wind change, prior action can be taken to increase the number of gangs on what is expected to be the new dangerous face. On days of "dangerous" fire hazard the Forestry Department has authority to stop the working of bush locomotives to prevent risk of fire from sparks.

RAILWAY RISKS LESSENED

Sparks from railway engines have in the past been responsible for many fires, and in an effort to combat this menace the Railway Department, in co-operation with the Weather Bureau, decided to set up a system whereby several selected stations throughout the agricultural districts are notified each morning of the expected fire hazard in the area.

This information together with the anticipated winds, is 'phoned to the Central Railway Station at 7 a.m. each day and disseminated through Railway communication channels to the various selected stations. **On days of "severe" to "dangerous" hazard the local Stationmaster has authority to prevent the use of any engine which is suspected of faults likely to allow the discharge of sparks.**

The Railway Department has recently issued a set of instructions to all officers concerning the care and maintenance of the spark arresting appliances, damper screens, brick arches, baffle plates, etc., on engines. A weekly certification

Map showing boundaries of agricultural districts for which forecasts are given.

that these are in perfect order is required and the condition of the spark arresting appliances is to be entered on the engineman's daily report sheet, and wherever an officer considers that a risk would be involved by working an engine through a dangerous section he is instructed to put back and wait until conditions are more favourable.

BROADCASTING TIMES

The fire hazard forecasts are broadcast from Monday to Friday over the National Stations at 6.30 a.m., 8.07 a.m., 5.11 p.m., 6.50 p.m., and 11.07 p.m.; on Saturdays, at 6.30 a.m., 8.07 a.m., 6.25 p.m. and 11.07 p.m.; and on Sundays, at 6.55 a.m., 8.50 a.m., 6.25 p.m. and 11.07 p.m.

It is hoped that by making this information available to the general public the otherwise inconsiderate or thoughtless person may become more fire-conscious with a consequent reduction in indiscriminate burning-off on days of "high" to "dangerous" hazards. It has been the practice in the past for many people to burn-off immediately the restrictions are lifted, irrespective of the degree of hazard, and this has been responsible for many of the more severe grass and forest fires.

The result of an intelligent use of fire hazard and wind forecasts is illustrated by the success of a combined burning-off programme undertaken during the last three summers at Cuballing, where a controlled burn of an area 20 miles long by a half-mile wide has been made on receipt of favourable advice from the Weather Bureau.

There seems little reason to doubt that a greater appreciation of the value of the fire hazard forecasts would lead to a considerable reduction in the loss of life, stock, timber and property during the next summer, and if the safety measures being adopted by the Railways were backed up by controlled burning by farmers and a more fire-conscious public, a great contribution to the national economy would be effected.

With the introduction of fire hazard forecasts for the agricultural areas some confusion has again risen concerning the boundaries of the various districts. In the accompanying maps the enlargement of the South-West Land Division details the boundaries of the agricultural districts for which forecasts are issued, and it would be advisable for anyone interested to note carefully the district in which his property is located.

NEW FLAX VARIETY

The Minister for Agriculture (Sir Charles Latham) announced recently that a new flax variety developed in this State had been accepted for registration and released for commercial cultivation.

The new variety named "Boyup" was the result of cross-breeding and selection work carried out by the Plant Breeding Section of the Department over a number of years. The initial selection was made in Departmental plots in the flax-growing areas, continued with at the Avondale Research Station and the final selection and testing was carried out at Boyup Brook, the centre of the flax industry in this State.

"Boyup" is a blue-flowered, early-maturing variety, the result of a natural cross between the locally selected "Wada" and the imported "Concurrent". Slightly taller-growing than "Wada" and possessing a stronger straw, it gives excellent yields of flax fibre.

"Boyup" possesses a higher degree of rust resistance than the other varieties. This was evident last season when crops of "Wada" and "Concurrent" growing alongside areas sown to "Boyup" were badly attacked, whereas the new variety was practically unaffected by flax rust.

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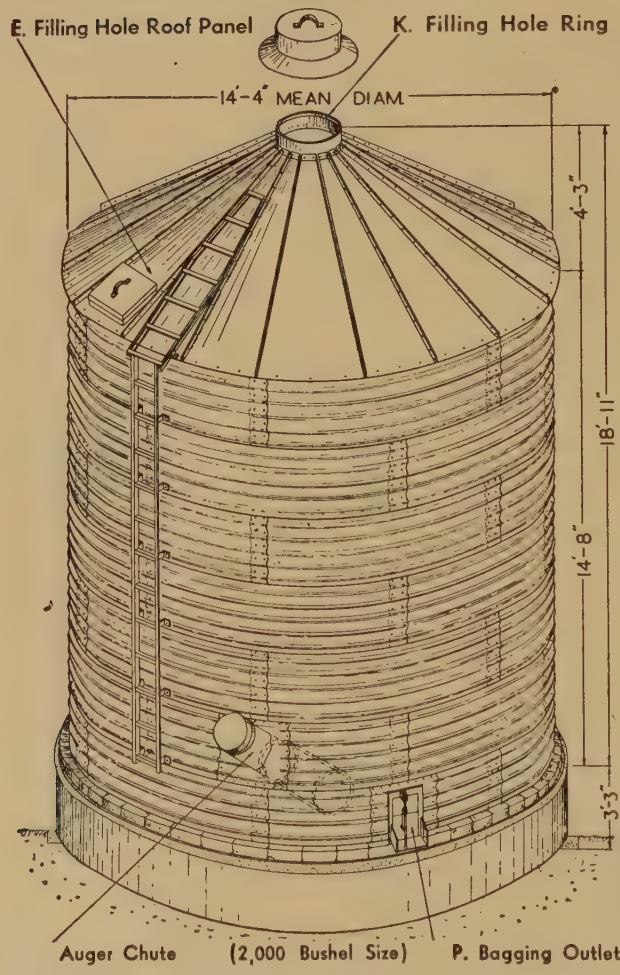

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THE SOIL ... OUR BASIC ASSET

WATER EROSION CONTROL—4

Selecting, Making, and Safe-guarding Waterways

By J. E. WATSON, B.Sc., Adviser, Soil Conservation Service

RUN-OFF water must be expected at some time or other from most agricultural land in Western Australia, where high intensity rains are likely to occur both in winter and summer. This run-off water will tend to concentrate in the natural drainage depressions of the slopes, and flow down to the main creeks. Running water is a principal agent of soil erosion, and it is essential that all channels where water flows must be protected if our lands are to be saved from the ravages of severe gully erosion.

When rain falls faster than it can be absorbed by the soil, the unabsorbed water collects in small pools in hollows in the soil surface. On sloping land, increasing accumulation causes the water to overflow from these hollows and commence to move downhill under the force of gravity.

Under natural vegetation the surface soil on the slopes is usually protected against running water by leaf mould on the surface and root systems in the soil. In the natural drainage depressions the vegetation (trees, scrub and grasses) is generally much thicker and so provides protection for the soil when a concentrated flow of water occurs. Actually these drainage depressions and in fact the whole topography of the land have been formed by geological erosion occurring over thousands of years. However, when we refer to soil erosion, we mean

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This series of articles outlines the principles of soil conservation and their main applications in W.A. It is hoped they will impress on farmers the need to conserve the soil and prevent erosion, and assist them in doing this. The Soil Conservation Service exists to co-operate with farmers for this purpose. If you would like a visit to discuss soil erosion, write to the Commissioner of Soil Conservation, Department of Agriculture, Perth.

accelerated erosion caused when the balance of nature is upset.

As man develops an area for agriculture the natural balance between water absorbed and used by vegetation, run off water, and the drainage pattern of the run-off water is upset. The protective vegetation is removed, root systems are destroyed, the soil is cultivated and left bare for varying periods and the crops grown often use less water than the natural vegetation. The amount of water which can be absorbed and the maximum rate of absorption are altered and more water is likely to run off the ground. Cultivation lines, fences, roads, railways, etc., may cause run-off water to concentrate and flow on unprotected soil, thus causing gully erosion. In view of this it is obvious that a system of land use must be achieved in which run-off water is kept to a minimum and can safely flow down to the permanent water courses without causing serious gully erosion.

Improved systems of soil management will increase the amount of water absorbed at or near where it falls. However, we must expect run-off water from most of our sloping agricultural lands. Contour banks can be used to intercept water flowing down a slope, and make it flow slowly across the slope. It is essential that the water diverted by such banks be discharged into a planned and stabilised water channel known as a waterway. A grassed waterway (a channel protected by a dense cover of grass) is the most economical and satisfactory waterway.

THE IDEAL WATERWAY

The essentials of a safe waterway are:—

(1) It needs to extend up the slope far enough to take the discharge from the top bank.

(2) It must be large enough to carry the water.

(3) It should have as small a gradient as possible.

(4) It should be readily protected against erosion by good plant cover and if necessary by simple earth structures.

(5) If possible it should be fenced off so that grazing can be carefully controlled. If the waterway needs to be sown to pasture and it cannot be fenced, then it should be sown in the same year as the rest of the paddock is cropped, so that there would be no grazing during that year.

(6) It must be designed so that the water will flow down it at a safe speed.

This can be accomplished by increasing the width of the channel so that the flowing water can spread over a wide area at a moderate depth. (It is a combination of depth and speed which gives running water its cutting power.) If the depth of flowing water is shallow the speed will be limited by the resistance provided by the grass cover. If the situation is such that the water would tend to concentrate, then mechanical structures may be necessary at intervals to slow the water and spread it over a wider area.

In practice various types of waterway have been tried and used in Western Australia, and these are now described.

Fig. 1 (top picture).—This gullied depression, stabilised with gully stops, is the waterway carrying the run-off from an area of 150 acres treated with contour banks. The gully was originally steep-sided and fast-flowing. The gully stops shown have been in position for four winters. In that time the gully edges have rounded off considerably and are becoming grassed, and much silt has been trapped above the gully stops. In the foreground, the cutting starting to work back from the gully has been caused by the contour bank on the left being discharged too close to the gully. The lower picture shows a close-up of a gully stop designed to intercept water flowing down the gully, and spread it over the grassed area adjacent. When the water rises higher in the gully, it will flow out around the bank. The white pegs mark the top of the bank and the white tape shows the line of flow of the water

—Photo., J. E. Watson

NATURAL DEPRESSIONS

It follows from the above discussion that an ideal waterway would be a shallow drainage depression, with no gullies, which had been left out of cultivation for many years. Such an area would get more moisture than the rest of the paddock and would develop a dense cover of grass—usually containing species which in the dry stage are unpalatable to stock. The result is that good all the year round grass cover is likely to be maintained.

IDEAL WATERWAYS ARE HARD TO FIND

However, it is rare to find such a depression in our crop lands, and usually an area must be specially treated to become a safe waterway. Often the most obvious erosion problem in a paddock is a large gully in the main drainage depression. In such a case there may be great difficulty in finding a suitable site for safe water disposal, and we are forced to consider using the gullied depression as a waterway. Experience has shown that in Western Australia this can be done safely if we can follow the general principles of waterway requirements as discussed earlier, especially points (4) and (6), which stress the need for grass cover and the reduction of velocity by spreading the flow over a wide area.

The gullies in the depressions were probably originally formed when a heavy rain caused a concentrated flow of water down the depression while it was in a cultivated condition. Once a gully is in existence, any further flows of water will concentrate in the narrow channel of the gully and a rapid flow will result. To stabilise the gully so that it will handle such a flow without further erosion, it is almost certain that well designed concrete structures will be required. This method of stabilising a gully is expensive and unlikely to be used in a normal erosion control programme in this State. It has been used on a gully carrying run-off from a catchment area to a large dam, where it was essential to get a maximum flow of water free of silt.

USE OF EROSION GULLIES AS WATERWAYS

However, if after a gully has formed in a depression, the farmer has kept well back from the edge of the gully when ploughing, there is likely to be a good grass cover on the uncultivated area. If this is so, it can be made safe for use as a waterway by building a series of gully stops which are designed to prevent any flow directly down the gully. The water is spread over the grassed area adjacent, thus increasing the area of flow and reducing the velocity.

GULLY STOPS

To build a gully stop the gully is first filled in with earth for a length sufficient to make a crossing for a tractor. On top of the filled-in area an earth bank is built of sufficient height to ensure that no water can flow over the top. This bank is continued outwards from the gully along a line surveyed with a fall (up to one per cent.) away from the gully. The water will fill up the gully above the stop and then be diverted out on to the grassed area. The stops are built from one and a half to three chains apart, depending on the situation. Small spreader furrows with a fall of one per cent. away from the gully may be required between gully stops to spread the water over the grassed area. Any water flowing back into the gully between the stops will be intercepted and dammed back by the next stop. Any soil coming off the paddock, or from the breaking down of the sides of the gully will be caught by the next stop and will be helping to silt up the gully.

The gully stops can be readily built by bull-dozer, front end loader, or tractor and scoop. If no implement for pushing dirt is available some shovel work may be required to make the gully crossable for the tractor and scoop.

If a gullied depression is used as a waterway, contour banks should be discharged well back (a half chain or more) from the edge of the gully, and a spreader furrow built just below the discharge point. If banks are carried right to the gully, the waterfall effect of the

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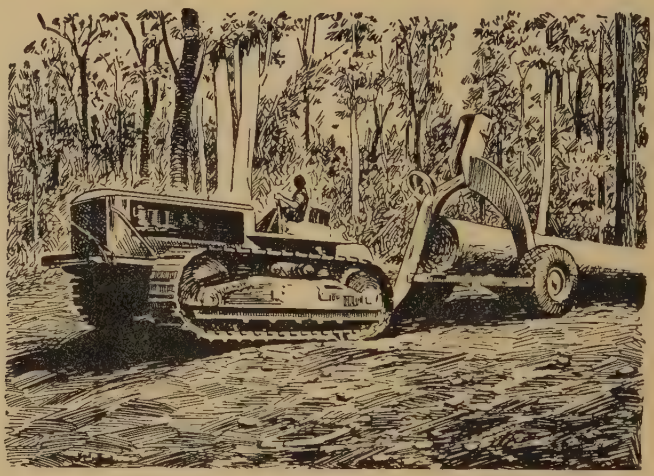

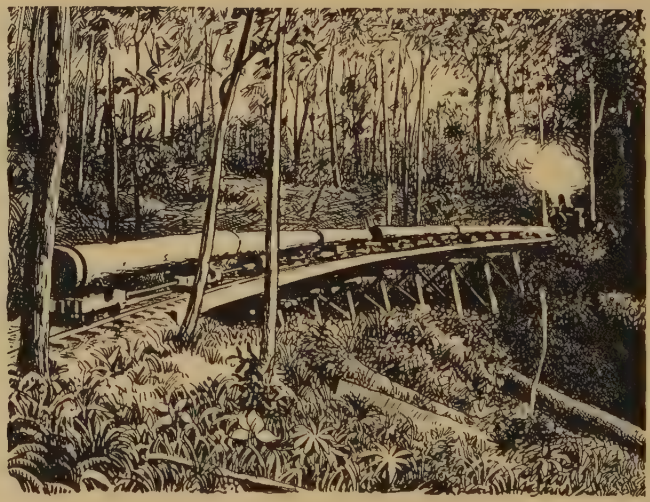

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Fig. 2.—An artificial waterway being graded to form a flat cross-sectioned channel with a bank either side. Such a waterway should be fenced off and sown to pasture. It should be left for two or three years before water from the contour bank system is discharged into it

—Photo., Government Printer

water spilling over the edge may cause headward erosion to work back along the contour bank channel.

Where a gullied depression is used as a waterway and all water from the area to be contour banked normally goes down that depression, it is best to build the banks at the same time as the waterway is prepared. The reason for this is that total run-off from an area is likely to be greatly reduced after the banks are put in.

Where there is a considerable side slope right to the edge of the gully, or where the area alongside the gully is not well grassed, there will be a definite risk in using this type of waterway. If there seems no alternative, and this risk is taken, the farmer must be prepared to make every effort to prevent damage occurring. Straw mulches should be spread on the area, and if necessary pinned down with old wire netting in danger spots, such as the ends of spreader banks. If water spilling back into the gully starts to cut a definite channel, the edge of the gully at this spot should be rounded off and protected with straw and wire netting.

If a gullied depression is becoming bare because of salt seepage it should be fenced off and planted with roots of Paspalum vaginatum, a salt-tolerant creeping grass.

ARTIFICIAL WATERWAYS

Where no natural depression is available as a suitable waterway, another possibility is an area of level or nearly level cross section, with gentle downward slope, which can be readily grassed and stabilised to carry a large volume of flowing water. A small bank may be necessary at one or both sides of the waterway to confine the water to the desired channel. Some small spreader furrows may be required to keep the water from concentrating against one side bank. Such a furrow is constructed along a line surveyed with a fall of not more than one per cent. away from the bank.

Attempts with small machinery (e.g., grader ditchers) for grading a level cross-section waterway have not been very successful in this State. Our topsoils are usually very shallow and if much grading is necessary the subsoil

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is exposed and there is little chance of getting a good grass cover quickly.

In much of our wheatbelt there is often likely to be a year when there are no rains of sufficient intensity to make the banks flow and discharge into the waterway. In such a year an artificial waterway would get no more moisture than that falling on its surface. In the same year a natural depression would get extra moisture from seepage and so is more likely to carry a good permanent cover of grass. For this reason it is more necessary to fence off an artificial waterway, and so the site is usually chosen alongside an existing fence line. New fencing will then only be required on one side.

TIME TO PREPARE WATERWAYS

The waterway should be prepared and adequately grassed before banks are discharged into it. This usually means that the waterway should be prepared two or three years before the banks are built. If the need for banks is urgent, they are often constructed at the same time as or soon after the waterway is prepared. In such a case it is better to discharge the banks short of the waterway and keep the water from entering it. If gullying occurs where the banks are discharged, these gullies can be filled in later when the banks are extended to the waterway.

GRASSING OF WATERWAYS

If the existing grass cover is not adequate it will be necessary to make every effort to establish one as quickly as possible. The area should be seeded soon after the opening winter rains so as to get a quick growth. There is scope for much experimental work with waterway seedings in this State. So far, subclover and Wimmera rye grass have been the only sown pastures. They are not always suitable as very few waterways have been fenced, and these grasses are likely to be grazed almost bare in summer. The ideal waterway grass would be quick-growing in winter, and in the dry stage unpalatable to stock.

Fig. 3.—This graded waterway was prepared at the same time as the banks were constructed to discharge into it. Before the waterway was stabilised and sufficiently protected by grass cover, heavy rain caused a flow of water which resulted in the damage shown in this photo.
—Photo., G. H. Burvill

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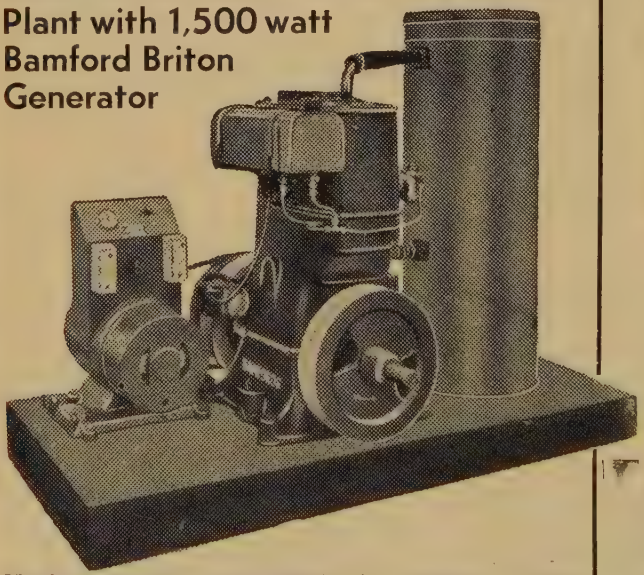

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Fig. 4.—This grassed area of nearly level cross section serves as the waterway carrying run-off from an area of about 45 acres. The lines of white pegs show the small banks at either side of the waterway. Note the area outside the waterway (between the left hand bank and the fence) which provides space for a road and a firebreak

—Photo., J. E. Watson

The best recommendation is for the area to be sown with anything which will give a good immediate cover. This will usually be Wimmera rye grass, subclover (in suitable rainfall areas) and a cereal cover crop. The cover crop should be cereal rye, or a strong-strawed variety of wheat, so that the stubble will give some protection in summer.

Other natural grasses such as barley grass, silver grass, etc., may be introduced by the use of a grass straw mulch. The grass straw could be cut and stored during late summer. A loose layer of up to two inches thick should be spread over the waterway immediately after seeding. The mulch would keep the surface soil moist after rain thus helping germination of the sown pastures. A good germination of the natural grasses could also be expected.

Where there is likely to be sufficient moisture, sod forming grasses such as couch and kikuyu should be planted in the waterway. In moist salty areas Paspalum vaginatum is the best grass.

OTHER WATER DISPOSAL AREAS

Sometimes in planning a contour bank system there is no alternative to discharging banks on to a steep area.

If this is so, a series of short lengths of large capacity absorption banks should be built. These banks should be close together and designed so that the water will fill the top bank and then flow around one end and down to the next bank and so on until it spills on to the head of the main waterway.

Banks may be discharged into timbered areas, but usually some spreader furrows or absorption banks will be required to prevent gullying.

In areas where water supplies depend on storage in dams (earth tanks), it is essential that these be considered in any scheme of water diversion. However, where discharge from a bank (or banks) flows into a dam it is necessary that a safe waterway be provided for overflow.

LARGE NATURAL CREEKS

Contour banks may sometimes discharge directly into a natural creek. If the creek has a steep bank some special attention may be needed to prevent gullying occurring where the water flows down into the creek.

Where a waterway joins a natural creek, it is even more important to ensure that there is no chance of a gully commencing and extending up the waterway.

Spring is here!

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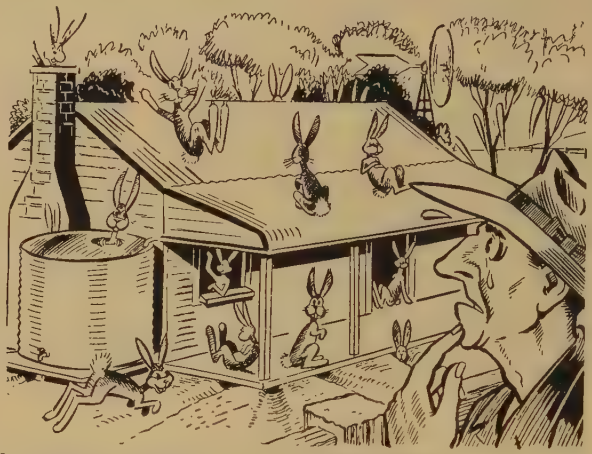

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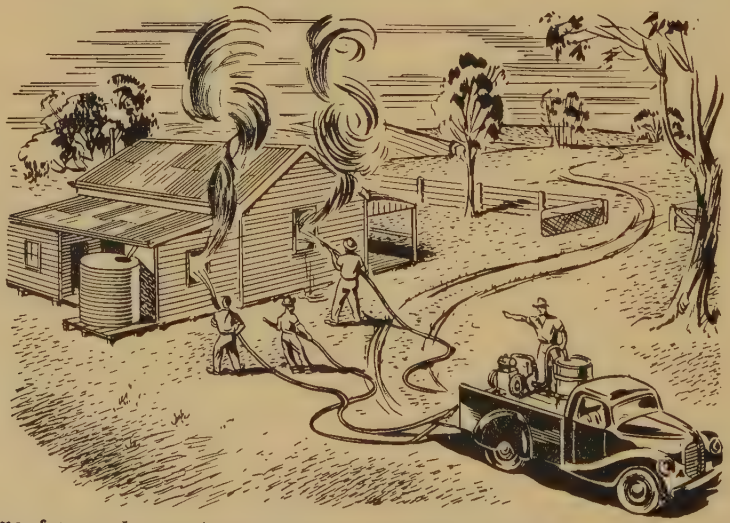

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Fig. 1.—This photograph shows the instrument in use in the field. A true contour line is being surveyed and pegs placed at fifty foot intervals to mark the line.

THE HOSE U-TUBE LEVEL

A Simple and Accurate Home Made Levelling Instrument

By J. P. FALLON, B.Sc.(Agric.), Adviser, Soil Conservation Service

WITH the growing use of soil conservation practices throughout the farming areas, there has been an increasing demand for a simple levelling device that will enable farmers to take their own levels. When they have become familiar with the use of pasture furrows, contour banks and the various other mechanical erosion control measures, farmers with the aid of such an instrument would be able to make an immediate start on an erosion control programme. The instrument would also prove useful for numerous small jobs around the farm when accurate levels are required. Tests have shown the "Hose U-Tube Level" here described, to be an accurate and reliable farm levelling instrument.

In a separate article to appear in the Water Erosion Control series in the Journal, the construction and use of several other simple levelling devices will be discussed. These levels include the carpenter's spirit level fitted with peep sights and mounted on a tripod; U-Tube water levels on tripods, and various types of A-frame levels. Although most of these instruments could be made by the farmer, some of them are complicated enough to need fairly skilled carpentry work if they are to be at all accurate. Most of them require some form of adjustment every time they are used and some are difficult to use. Moreover, the accuracy of even the best of them is at the most somewhat doubtful. The hose level outclasses these other types of instrument in that it has the three essential features needed for a good home-made levelling device. It is easy to make, easy to use and is both accurate and reliable.

PRINCIPLE AND CONSTRUCTION

This level consists of a U-tube open at both ends and partly filled with water. The water rises to the same level in both arms of the tube. In the type of U-tube level designed for soil conservation work the U-tube was made up, as shown in the diagram, of two 3ft. lengths of colourless plastic waterpipe joined by

THE HOSE U-TUBE LEVEL

Since the formation of the Soil Conservation Service in this State, officers of the S.C.S. have examined published descriptions of many devices for taking levels, and a number of these have been constructed and tested by Mr. J. P. Fallon, the author of this article.

The "Hose U-Tube Level", devised and built by Mr. Fallon, is immensely superior to any of these devices and is an instrument which can be made easily by any handyman, and which will always give accurate and reliable levels.

L. C. LIGHTFOOT,
Assistant Commissioner of Soil Conservation.

a 60ft. length of quarter-inch three-ply or two-braid air hose. Any length of hose may be used, the limit being determined only by the need for ease of handling of the system in the field. The lengths of plastic waterpipe were bolted to 6ft. lengths of light wood battern. An adjustable foot was fitted to one of the battens. Movable pointers were also attached to each batten or staff. Small taps fitted to the ends of the plastic waterpipe serve to prevent loss of water from the system during transport (for construction details see diagrams).

Care must be taken in filling the system to ensure that air bubbles do not form in the hose. A steady pressure of water should be allowed to flow through the system by connecting the hose to a tap and allowing the tap to run for a few minutes. When all air bubbles are expelled and while the system is still full of water, the top gas tap is closed and the hose removed from the water tap and screwed to the end of the plastic pipe. When the top gas taps are open, the water finds its own level at about

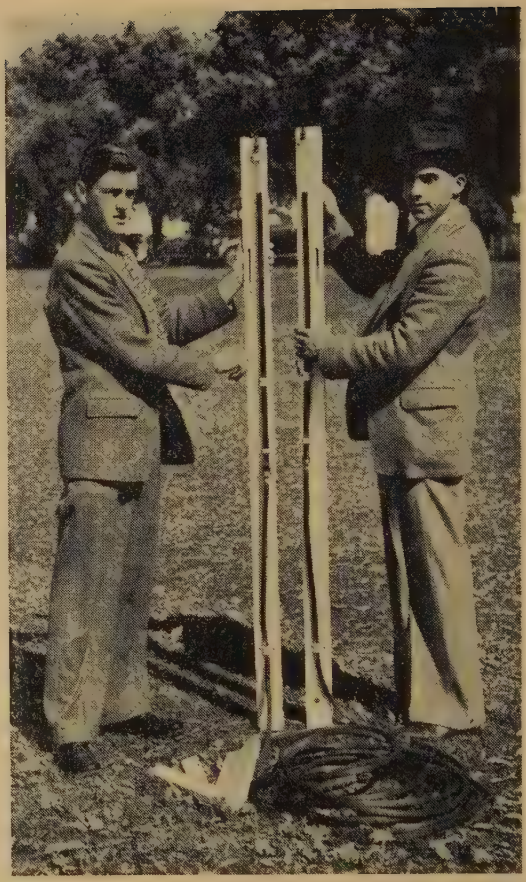

Fig. 2.—Setting of the water level indicators on the Hose U-tube level before surveying a contour line. The staves are set side by side on level ground and the pointers are adjusted to the level of the water. The water in the system has been coloured with red ink to more clearly define the water surface.

the centre of the pipes. (It is convenient to have the level of the water surfaces as near as possible to eye level.) The instrument is now ready for use.

USING THE HOSE U-TUBE LEVEL

Two persons are required to operate the instrument and in this description, they will be referred to as A and B. To mark out true contour lines the two battens or staves are set up vertically side by side on level ground. When the water in the system has come to rest, the pointer on each staff is set at the water level which is of course at the same

height in each pipe. Staff man A then moves around the slope to the extent of the length of the hose and moves the staff up or down the slope as required until the level of the water in each pipe is again at the pointers. **These two sites are at the same level and are now pegged or marked in some way.**

Fig. 3.—This photograph shows the adjustable foot which is fitted to one of the staves. The foot is extended to show details of its construction.

Staff man B now moves to where A was and A moves on another hose length around the slope and again brings the staff to the site where the water level is at the pointers. This procedure is repeated until the entire line has been surveyed. It is suggested that the two staves be kept facing each other when levelling. This is convenient and has the advantage that the staves are used in the same position relative to the ground slope. When the leading staff man finds the correct location for his staff, he must be careful to peg the site in same position relative to the foot of the staff each time (e.g., in the centre position at the back of the staff, or at the same corner of the staff). When the other staff man moves up to the peg placed by the leading man, knowing the system being used, he must be careful to place the staff in the correct position (e.g., if the leading man placed the peg at the centre position behind the staff, then the other man must also locate the foot of his staff in this position). If this is done, the resulting line will be more accurate than if the staff positions are not systematically marked.

When moving from one site to another it will be found necessary to close the taps at the tops of the plastic pipes to prevent water squirting from the system.

SURVEYING GRADED LINES

To run a line on a gradient, it is necessary to make use of the adjustable foot on one of the staves. When using this instrument to run graded lines for the first time, be careful not to set the required grade on the adjustable foot before adjusting the water level pointers. If this is done, the line surveyed with the instrument will be on a true contour and not on a grade. If the following procedure is carried out carefully, no mistake will be made.

(1) The staves are first set side by side and the pointers adjusted to mark the level of the water as in preparation for running a contour line.

(2) The foot is then adjusted to give the required grade. To run a gradient of six inches per 100ft. with a 50ft. length of hose between staves would require the

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leading staff to be extended three inches by means of the adjustable foot. The foot is therefore extended three inches and bolted in this position.

N.B.—Don't make the mistake of extending the foot to run a gradient before adjusting the water level markers. Always adjust the markers, then extend the foot.

(3) Staff man A takes the staff with the adjustable foot and walks around the slope to the extent of the hose. He then moves up or down until the water level is again at the pointers. This site is then three inches below that at which B is standing.

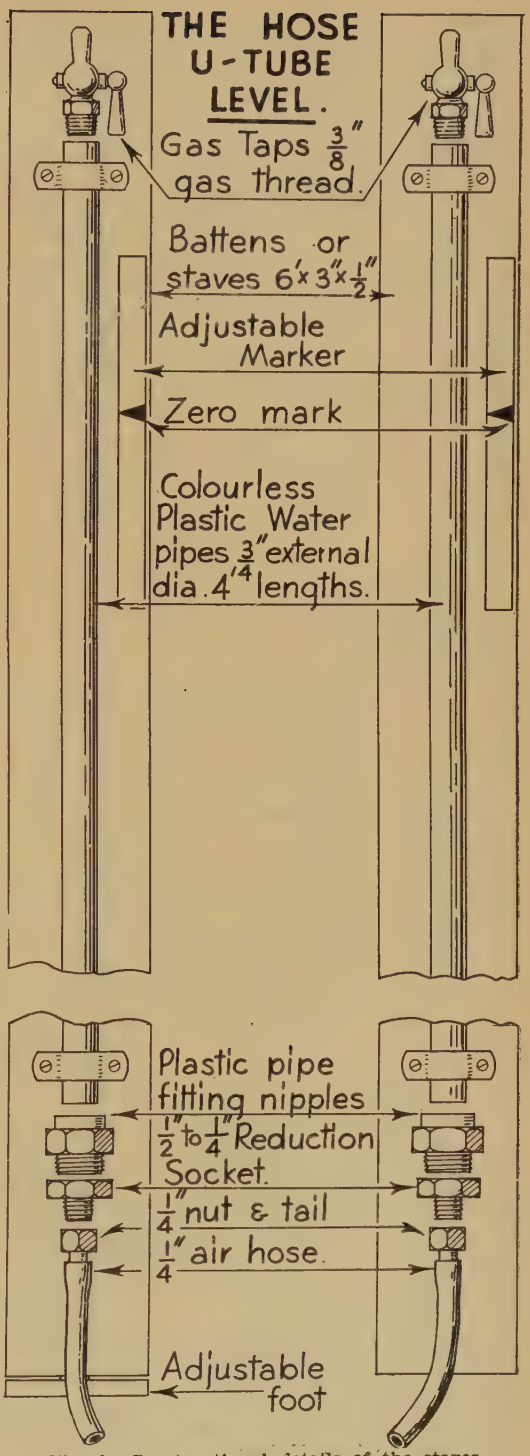
(4) Staff man B then walks to A, and A moves on around the slope and the process is repeated until the line is completed or a point reached where it is necessary to change the gradient.

If a variable grade is required, when the point is reached where the grade needs to be increased or decreased the length of the foot is re-adjusted to give the new grade. A tabulation of the amount to extend the foot to give various grades is set out below.

TABULATION OF GRADIENTS FOR CONTOUR BANKS

Grade in %	Grade in inches/50 feet
0.1%	0.6 ins. per 50 feet
0.2%	1.2 ins. per 50 feet
0.3%	1.8 ins. per 50 feet
0.4%	2.4 ins. per 50 feet
0.5%	3.0 ins. per 50 feet
0.6%	3.6 ins. per 50 feet
0.7%	4.2 ins. per 50 feet
0.8%	4.8 ins. per 50 feet
0.9%	5.4 ins. per 50 feet
1.0%	6 ins. per 50 feet

The accompanying diagrams show an adjustable foot with quarter-inch holes spaced six-tenths of an inch (0.6 inches) apart. This is the most convenient spacing of the holes if a 60ft. length of hose is used. A 60ft. hose gives an effective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Plastic pipe fitting nipples
1/2" to 1/4" Reduction Socket.
1/4" nut & tail
1/4" air hose.
Adjustable foot

Fig. 4.—Constructional details of the staves.

length of 50ft. between staves. However, levels may be taken at any point up to 50ft. apart. When surveying a line around sharp curves on ridges or in depressions, pegs should be placed at rather closer intervals than 50ft. In these situations a 25ft. spacing of pegs will give a more accurate line, but the adjustable foot will need to be reset for

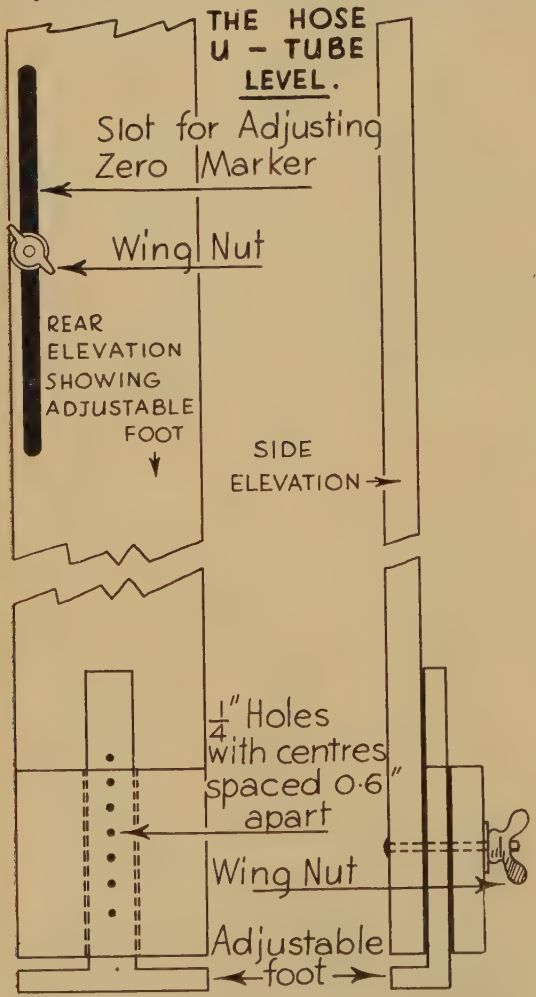

Fig. 5.—Constructional details of the adjustable foot.

the new spacing if the same grade is to be maintained. When running graded lines it is important to remember that if the distance between the staves is altered, the gradient of the resulting line will also be altered unless the foot is adjusted to the distance used.

DETERMINATION OF VERTICAL INTERVALS

To determine vertical intervals with the level, the staves are again set up side by side and the pointers adjusted so that the zero marks are at the level of the water. One staff man then walks down hill at right angles to the contour almost to the extent of the hose. As he moves downhill, he raises the staff in the air until advised to stop by the other staff man when the level of the water is again at the zero mark.

Loss of water from the system can be avoided if the man at the higher level turns the tap on and off as needed until equilibrium is reached when the tap is left open. The vertical interval from the staff man above to the man below is the height of the foot of the staff, held by the lower man, from the ground. For most practical purposes unless really accurate vertical intervals are required, the height of the foot of the staff may be estimated using the height of the person holding the staff as a standard. Alternatively, a tape measure may be glued to the staff.

The operation of this levelling instrument depends on certain principles and as long as these principles are adhered to, variations in the details of its construction may be made in many places. For instance, instead of having an adjustable foot on one of the staves in order to run a graded line, the same effect may be obtained by using the sliding scales, or zero markers, if they are graduated. In this method, the staves are set side by side and the zero markers moved to the level of the water in the pipes. The required grade is obtained by setting half the grade on each scale by moving one pointer up on one staff and the other down on the other staff.

In actual tests, this instrument has proved itself an accurate makeshift level. Carefully used, it gives results well within the limits of accuracy considered adequate when using a surveyor's dumpy level for soil conservation work.

The instrument has an additional advantage over other levels in that there is a double check on all readings. Each of the two people using the level can see at a glance whether or not the correct reading has been obtained. If the water level on one staff is at the correct position, then the level of the water on the other staff must also be correct.

However, an important point to remember when using this type of instrument is that nearly all the errors that are likely to be made are cumulative errors. For instance, if the zero markers are adjusted when the staves are not on level ground, an error of perhaps one half inch may be made. This means that the difference in level of the first two pegs of a contour line would be one half inch, which doesn't sound much. However, the difference between pegs one and three would be one inch and between one and four one and one half inches, and so on. In effect, a graded line would be run instead of a contour line. Similarly, to get accurate grades, the spacings of the holes in the adjustable foot must be accurate. As long as the persons using the level are aware of the possible pitfalls in the use of the instrument they can readily avoid them and, with very little effort, do really accurate work.

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AT THE WICKEPIN SCHOOL

1.—Mr B Marsh (S C S. Adviser) explains the contour earthworks on the school site with the aid of a blackboard.
2.—School member Mr. E. Stott acts as staff man.
3.—Using the hose level—Messrs. H. H. Henderson, P. J. Healy, H. Kett, D. J. Fleay (S.C.S. Adviser), A. R. McDonald and J. Rose.
4.—One of the gullies in the school site paddock.

SOIL-SAVING SCHOOLS

Farmers Prove Apt Pupils

"SAVE the soil for your sons and grandsons," or "Every farmer his own soil conservationist" might well serve as slogans for the recently-inaugurated farmers' schools organised in this State by the Soil Conservation Service. Judging by the enthusiasm shown by pupils at the first two schools, held in August last, this highly practical approach to an important subject seems destined to usher in an entirely new conception of soil conservation work as it affects the individual land-owner.

The fact that good soil husbandry—especially in the direction of pasture establishment and maintenance—must always remain the first line of defence against soil erosion, was emphasised by the Assistant Commissioner for Soil Conservation (Mr. L. C. Lightfoot) in explaining the objects of the schools.

Mr. Lightfoot, who has been in charge of the organisation of the schools, said that most farmers were anxious to increase and improve their pastures. Apart from their value in soil conservation, improved pastures represented increased stock-carrying capacity. They provided a means of increasing soil fertility and were an avenue to greater profits.

PASTURES NOT ALWAYS SUFFICIENT

In the soil conservation sphere however, the pastures alone were not always sufficient to protect the soil from erosion. On sloping soils they frequently needed to be augmented by earthworks such as contour banks, pasture furrows, absorption banks and gully stops, the planning, surveying and construction of which was regarded by most farmers as "a job for the experts".

Admittedly, where serious erosion has already taken place; where valuable topsoil has gone beyond recall, and sheet erosion, gullying and drift have exacted their grim and greedy toll on a large scale, the task of arresting the damage is definitely one calling for specialised knowledge. To heal the scars caused by erosion and to bring back fertility to sick soil, technical skill and special equipment are needed —and unfortunately we have enough of these major projects in Western Australia to keep the trained staff of the Soil Conservation Service busy for some years to come.

On thousands of farms throughout the State, however, are less serious examples of erosion—minor soil problems which, as yet, have not progressed beyond the "nuisance stage" but which, if neglected, may become the major problems of the future.

Given suitable training, the average farmer is quite capable of handling these threats to his soil and the provision of such training is the purpose of the soil conservation schools which are being organised in the agricultural areas.

AIDS TO SELF-HELP

The schools are designed to help farmers to help themselves—to teach them sufficient of the theory and practice of soil conservation work to enable them to check tendencies toward soil erosion on their properties before the damage is serious enough to require the

THE IRISHTOWN SCHOOL. 1—Mr. D. J. Fleay (S.C.S Adviser) explains the works planned for the school paddock. Completed banks and marked-out lines in background. 2—Mr. J. Smith on tractor and Mr. J. E. Watson (S.C.S. Adviser) building contour bank with grader-ditcher. 3—Building a gully stop with small tractor and dozer blade. 4—Building an absorption bank with farm tractor and dozer blade.

advice and supervision of trained soil conservationists.

The schools are carefully organised by the Soil Conservation Service working in close association with local organisations such as Road Boards, Pasture Improvement Groups, District Agricultural Societies, Progress Associations or Farmers' Union Branches, and such bodies must be willing to shoulder a goodly proportion of the preliminary groundwork.

Their roles will mainly lie in the direction of enrolling pupils willing to attend the classes; selecting possible sites for both the actual school and for

A home-made bulldozer being used to construct a gully stop at the Wickepin School. Mr. B. Woodward stands on side of tractor (driven by Mr. C. W. Jackson) to operate lever controls. On his own tractor, Mr. Woodward has a hydraulic lift to raise and lower the blade.

inspection visits to examples of soil erosion in the area; and on occasions arranging for the loan of tractors, ploughs, and other implements needed to demonstrate earthworks construction.

Officers of the Soil Conservation Service will be available to help decide on the best site for the school, preferably one showing the greatest possible diversity of simple erosion control treatment needs and one that is reasonably easy of access and near a main road or township. The S.C.S. officers will be ready at all times to assist and advise on matters connected with the organisation of the schools.

Schools will generally be of one or two days duration and the general pattern will be on the following lines.

An inspection of the school site will be followed by discussion of the erosion which has taken, or is taking place, together with the recommended remedial measures. The reasons for using different methods to fit differing needs will be given throughout the school as opportunity offers.

Farmers will be instructed in the use of surveying instruments such as the surveyor's level (usually called a dumpy level) as well as the operation of simple levelling devices which they can construct themselves at little cost. After instruction, the pupils will be given opportunities to operate the instruments by laying out lines for pasture furrows and contour banks.

Inspection of previously-constructed contour banks, pasture furrows, gully stops and other earthworks may be followed by demonstrations of their construction using farm tractors and standard farm implements such as ploughs. Where available machines such as grader-ditchers, rabbit rippers, scoops and dozer-blades fitted to farm tractors will be shown in operation under conditions where they may be used effectively.

The classes will inspect soil erosion control projects which have already been carried out in the district and also examples of erosion which may be used to illustrate particular lessons. At all stages of the school, suitable commentaries will be given by S.C.S. officers, and pupils will be encouraged to ask questions.

Upon completion of the school and if requests are made, officers of the S.C.S. will make individual visits to the farms of the pupils in order to advise and

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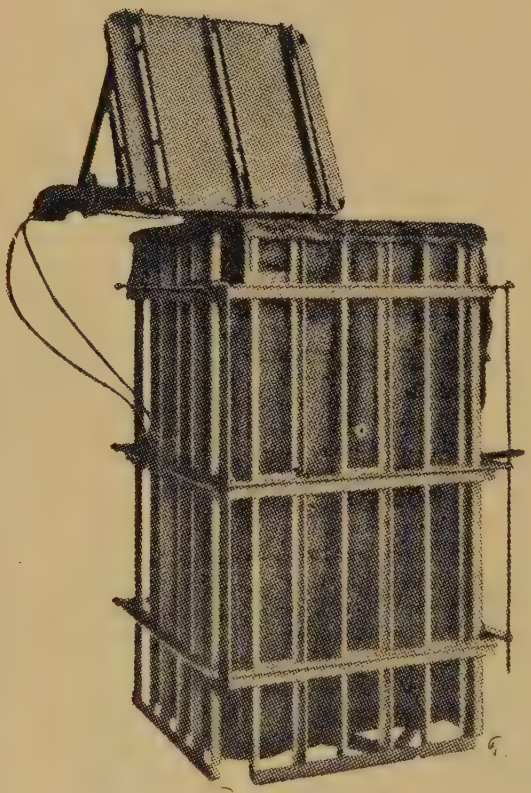

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THE INAUGURAL SCHOOL

Through the activities of the Wickepin District Pasture Improvement Group there has been more call on the Soil Conservation Service from Wickepin than from any other district during the last two or three years. The inaugural Soil Conservation School commencing on August 4 was therefore fittingly held in that district.

The enthusiasm of the Chairman of the Group (Mr. C. G. Russell) and the Honorary Secretary (Mr. F. H. Miller) was particularly noticeable and the school attracted a number of pupils from Wickepin, Yealering, Dudinin, Toolibin, Tinkurrin, Harrismith and East Pingelly.

The capacity of the water-channel behind this contour bank (built at Wickepin with farm tractor and disc plough by Mr. C. W. Jackson) is indicated by Mr. G. W. Spencer (S.C.S. Adviser). Staff shows effective depth of 19 inches.

The school was held in a paddock on the property of Mr. A. R. McDonald about five miles north-west of Dudinin, and the site chosen was an excellent one incorporating slopes from one of the gravelly hills originally carrying mallet timber—a type of country which is frequently subject to erosion troubles in these districts.

Some fairly severe gullying had already taken place on the paddock and the overall plan as described and illustrated on the blackboard by one of the S.C.S. Advisers, included the construction of a number of pasture furrows on the steep rock slopes and a system of contour banks of varying lengths discharging into a suitable waterway.

Some gullying had already taken place in the selected waterway, necessitating the construction of gully stops with spreader wings, and with this amount of work to be undertaken there was ample scope for the amateur surveyors to get busy with a variety of instruments. Those shown were of several types but undoubtedly the most popular device was the U-type hose level designed and constructed by one of the Soil Conservation Service Advisers. This device is fully explained and illustrated in an article in this issue.

Demonstrations of contour bank construction using a farm tractor and a twin-disc plough attracted keen attention and this was followed by similar demonstrations using mouldboard ploughs and a grader-ditcher for making pasture furrows.

A farm-made dozer blade fitted to a farm tractor was used for gully stop construction and the practical demonstrations combined with discussion provided farmers with a sound foundation for any individual soil conservation projects which they may undertake in the future.

THE IRISHTOWN SCHOOL

The second soil conservation school was opened on the "Bucklands" property of Mr. Sinclair McIntosh near Irishtown on August 25.

The Irishtown Pasture & Soil Conservation Group, which co-operated with the Soil Conservation Service in the organisation of the school, is a highly progressive body which, ever since its inception, has worked hand in

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General view of contour banks under construction with various types of small equipment at Irishtown.

hand with the Department of Agriculture in efforts to solve local problems.

In officially opening the school, Mr. E. Lee Steere, a member of the Soil Conservation Advisory Board, paid a warm tribute to the work of the Group whose members had repeatedly shown a willingness to help themselves and others.

His remarks were endorsed by the Commissioner for Soil Conservation (Mr. G. H. Burvil) who said that it was organisations such as the Irishtown Group which, over the past ten years, had rendered a great service to the State and the nation.

Officers of the S.C.S. had carried out work on this property over a number of years and the pupils at this school were given opportunities of inspecting the various types of earthworks.

Pupils were instructed in the use of various levelling instruments and demonstrations of bank building were carried out using standard farm implements and a grader-ditcher.

At the conclusion of the school, the Assistant Commissioner for Soil Conservation (Mr. L. C. Lightfoot) said that the keen interest of the farmer pupils, the quantity and variety of equipment made available and the excellent weather and soil conditions had combined to make the school an outstanding success.

He felt that these schools would be of great value to farmers and said that he hoped that they would be the first of many to be held in other parts of the State. The S.C.S. would always be prepared to co-operate with local organisations in arranging schools, but this did not mean that it would cease to carry out the individual advisory work.

Officers of the S.C.S. will still be available to visit farmers seeking advice on soil conservation matters, he said, but he felt that schools such as these would enable many smaller erosion problems to be tackled promptly by the land-owners themselves.

A REMINDER

HAVE you registered your orchard? One fruit tree or a single vine is an orchard for the purposes of the Plant Diseases Act and must be registered accordingly. The registration fee for less than one acre of trees or vines is 1s. Apply Department of Agriculture, Perth.

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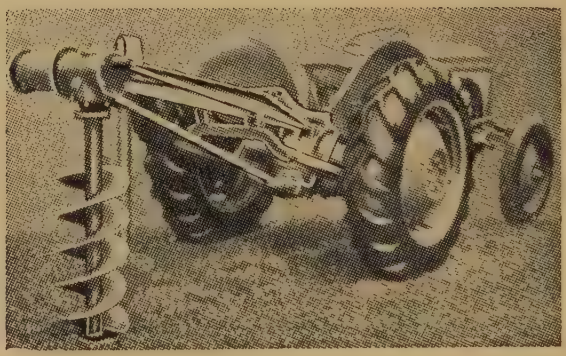

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A SUCCESSFUL METHOD OF SPRAYING AGAINST LOOPER CATERPILLARS AND OTHER SPRINGTIME PESTS

By J. C. ROWBOTHAM, Horticultural Instructor.

A DESCRIPTION of a method which has proved successful over the past two seasons on the orchards of Messrs. J. L. Parke and W. Parke, of Donnybrook, should prove of interest to the large number of apple growers who during past seasons have suffered losses due to excessive blemishing of fruit by looper caterpillars (Chloroclystis lacticostata) and other spring pests.

Before growers will accept any suggestion of change from accepted practices the questions asked will be firstly, "Is the cost of this method less than the old?" and secondly, "Do results justify a trial"

The following description should prove beyond all doubt that there is not only a saving on all the costs of actual spraying, but also there is a bigger return from the higher quality fruit produced.

Although both the orchards mentioned received the same treatment, for the sake of simplicity the figures to be quoted will refer only to the operations carried out on the property of Mr. J. L. Parke. This orchard consists of about 1,000 apple trees, mainly Granny Smiths, the other interplanted varieties being Yates and Delicious. If the orchard had contained earlier varieties such as Cleopatras and Jonathans, these trees would have been sprayed a little earlier to meet the slightly advanced time of flowering.

The spraying outfit used by Mr. Parke was self-built and has a vat capacity of 135 gallons, the pump being driven by a power take-off from the tractor which tows the plant. As it was considered that the sprayer would have been overloaded had the hose operators ridden on it, a trailer was attached to carry them (Fig. 1). It is intended for future operations to secure a heavier unit which will carry the two men and dispense with the trailer.

Before describing the actual spraying operation, it is well to state here that a

Fig. 1.—The home-made power sprayer used by Mr. J. L. Parke, which was used to such good effect. The tractor was driven along every alternate space between the rows of trees.

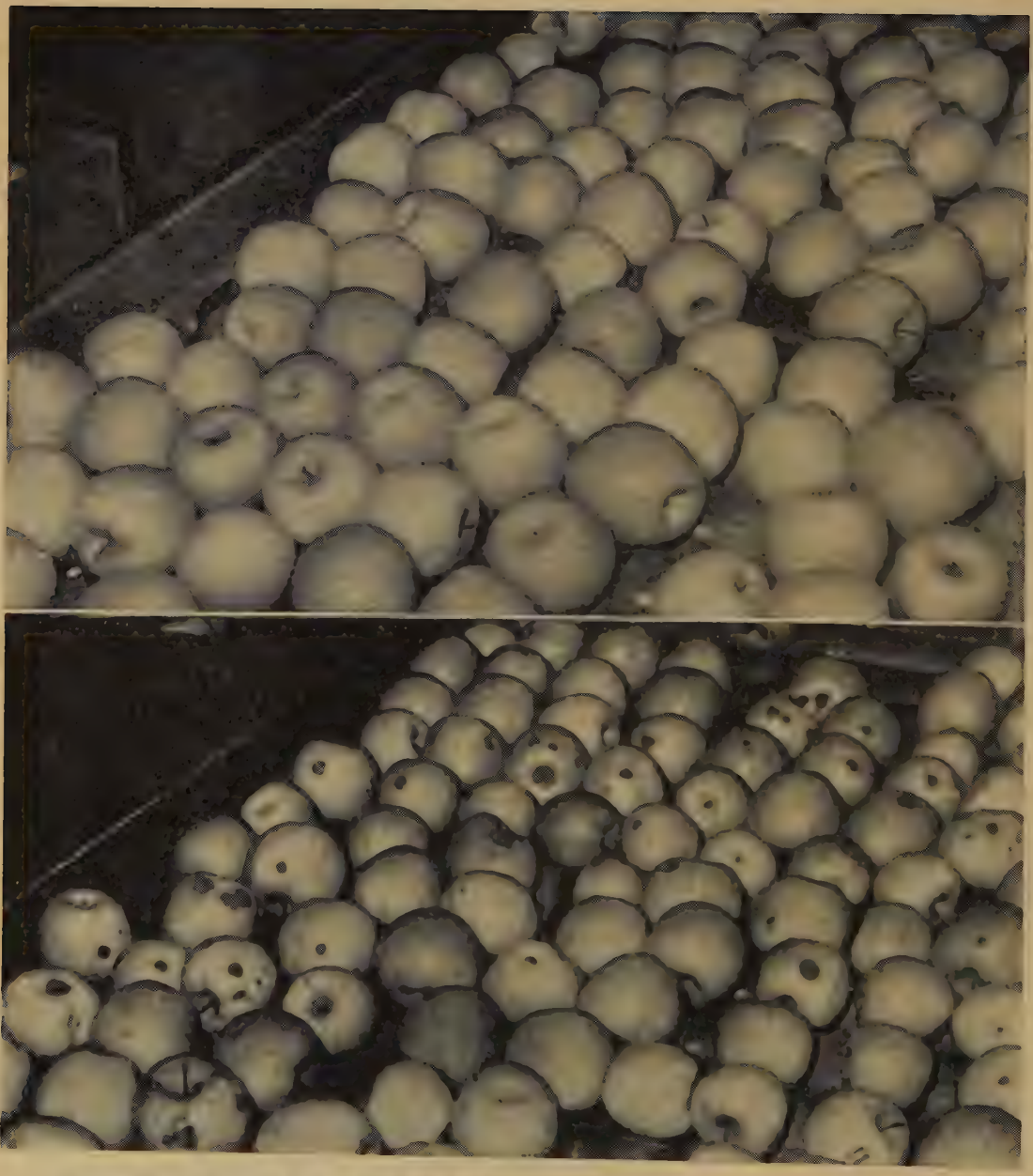

Fig. 2—The top picture shows the excellent result of spraying to control looper caterpillars, an attractive line of Mr. Parke's Granny Smiths on the rollers. The lower picture reveals the blemishes caused by the caterpillars on a line of unsprayed Granny Smiths. Both photographs were taken showing fruit on the rollers of a packing house at Donnybrook.

winter or dormant spray consisting of red oil at the rate of 1 gallon to 18 gallons of water was applied in August in the usual manner, using the same outfit minus the trailer. The sprayer was driven down each row and the operators, using hoses, walked around each tree. The time taken was two and a half (2½) days and 11½ vats of spray mixture was used.

For the looper spray only two vats, totalling 270 gallons were necessary and the time taken, including the mixing, was half a day or about one-fifth of the time required normally. The operators travelled on the trailer and sprayed the trees while moving at 3½ to 4 miles per hour. The plant was driven down each second row only, so that trees were sprayed from one side. Complete coverage was neither aimed at nor achieved. The insecticide used was 20% D.D.T. emulsion and the quantity was 1½ gallons or ¾ gallon to each vat of 135 gallons the concentration was approximately 0.1%.

Good control was assured because being a contact spray any egg laying moths moving around the trees would die and any grubs hatching and crawling around in search of apples would be killed also.

The spray was applied at a pressure of 200lb. to the square inch using Myers "Way" nozzles, which deliver a rather coarse stream. The time chosen was at late petal fall, that is when the largest apples were as big as peas, and a few late blossoms were still showing on the trees.

The biggest factor to be considered in successful control of loopers is the fact that there are only a critical few days during which any spray will check the pest. If the weather is at all unsettled during this period it will be readily conceded that it is much easier for a grower to find three or four hours of suitable conditions than the two or three days needed for the slower method.

In the comparison of costs in the following table it has been assumed that if the usual looper spray had been applied Mr. Parke would have used 11½ vats of mixture and needed 2½ days to do the job, as was the case with the oil spray.

	Parke's Method*			Old Method		
	£	s.	d.	£	s.	d.
1. Labour, based on three men at £2 15s. a day	4	2	6	20	12	6
2. Materials	2	18	6	16	11	6
3. Fuel for tractor		8	1	2	0	5
	£7	9	1	£39	4	5

* 1½ gals. 20% D.D.T. Emulsion and time ½ day, as against 8½ gals. D.D.T. over 2½ days.

All costs based on prices at present ruling in Donnybrook.

As for the results, it can be said that at picking time Mr. Parke's crop was of excellent quality, looper and cut-worm marks could not be found and all fruit was remarkably free of malformation and dimpling.

Out of the first "run" of 95 cases delivered to the packing shed there were 74 cases of export quality, four boxes of oversized fruit and four boxes of culls, mostly sunburn. Over the whole of the crop handled the fact that there were only 44 boxes of rejects and Good grade per 1,000 boxes picked speaks volumes. In contrast to this, on an adjoining unsprayed orchard the owner states that looper damage this past season has cost him £600.

Another nearby grower whose apple trees could have been sprayed by the usual method in about five days, found that 15 days had elapsed between start and finish. He has lost about 40% through blemishes and some fruit was worse than Good grade.

For the orchardist who produces a lot of Cleopatras (caterpillars are rather partial to Cleos.) a line packing 40%

Good grade and worse would show a poor return. Fancy Export Cleopatras net return this season was 13s. to 14s. per case, while the net return for Good grade was from 4s. to 7s.

As for the difference in returns in the case of Granny Smiths, a glance at the two lines depicted on the sorting table at the packing shed (Fig. 2) gives some idea of the difference in quality. Prices paid for Fancy Granny Smiths ranged from 27s. to 32s. f.o.r. and Good grade returned from 16s. to 22s. f.o.r. at Donnybrook. The really badly marked apples were selling at about 11s. including cost of a new case.

RAISING JAPANESE PLUM TREES FROM CUTTINGS

OCCASIONALLY prunings from Japanese plums used as stakes for peas, root readily and in a number of instances have made good trees. This applies particularly to such varieties as Santa Rosa and Satsuma. Interesting evidence of the performance of another variety has recently come from a Bedfordale grower, Mr. J. E. Dowell. Last year, after pruning a new Japanese variety called Purple King, he planted 18 cuttings, each about nine inches in length, in moist black loamy soil. The cuttings grew vigorously and in some instances a single shoot approximated to eight feet in length.

This information is presented from the point of view of an interesting development rather than a recommendation that Japanese plums should be propagated from cuttings. However, as far as this variety is concerned, there does appear some evidence that it would make a vigorous stock for other varieties of Japanese plums.—H.R.P.

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EXPLANATION OF PLATE

Crotalaria retusa L. A—Habit showing flowers and pods. B—A broad leaf from flower part of plant. C—Flowers. D—Calyx. E—Pods. F—Seed. (C and D natural size; all others half natural size.) Gogo, Fitzroy River, April, 1951.

Icon. origin.

THE WEDGE-LEAVED RATTLEPOD
(*Crotalaria retusa* L.)

A Poison Plant of Tropical Australia

By C. A. GARDNER, Government Botanist

DURING the last two years, work has been in progress near Fitzroy Crossing (West Kimberley) upon an investigation to determine the cause of Kimberley Horse Disease, commonly known as "Walkabout Disease." The investigations are still in progress, and the findings when completed, will be published elsewhere, but the discovery that Crotalaria retusa L. is a cause—and probably the major cause —of this disease is of considerable importance. Because of this it is considered advisable to assist pastoralists to recognise the plant and by providing information on its habit, occurrence and distribution, to enable them to take steps to minimise losses during the coming season.

Crotalaria retusa was examined by Greshoff in the Botanic Gardens at Buitenzorg in 1890, and found to contain a toxic alkaloid. This was later confirmed in the United States of America in 1939, when the alkaloid was found to be monocrotaline.

Earlier than this, in 1884, an allied species (*Crotalaria sagittalis* L.) was reported as the cause of "Missouri River Bottom Disease" which resulted in death among horses.

Since then, other species have been shown to be toxic, notably C. *spectabilis* Roth. from the United States of America, where it causes heavy losses among horses and cattle, as well as being toxic to pigs and fowls. Here again the alkaloid is monocrotaline, as in *C retusa*. The Sunn Hemp (*C. juncea* L.) is toxic to sheep in South Africa, and this species is not uncommon along some of the watercourses in Kimberley.

Other toxic species are *Crotalaria dura* Wood and Evans (toxic to horses); *C. Burkeana* Benth. (toxic to cattle), and *C. Grantiana* Harv., these three being native to South Africa.

The alkaloids involved are monocrotaline, dicrotaline and grantianine, all of which probably have retronecine as a basic unit. Retronecine, which is known to be present in *C. retusa* and *C. spectabilis* and also in several species of *Senecio* ("Ragwort"), is known to cause damage to the liver cells and is usually slow in action.

The presence of *Crotalaria retusa* in considerable abundance in certain areas in Kimberley appears to be of great economic importance in view of the heavy losses in horses which have been sustained on the holdings in which the plant is most common, and it is hoped that the accompanying plates will be of value in assisting in the identification of this plant.

GENERAL NOTES

Crotalaria retusa is an annual plant. It germinates with the early summer rains of December or January, and

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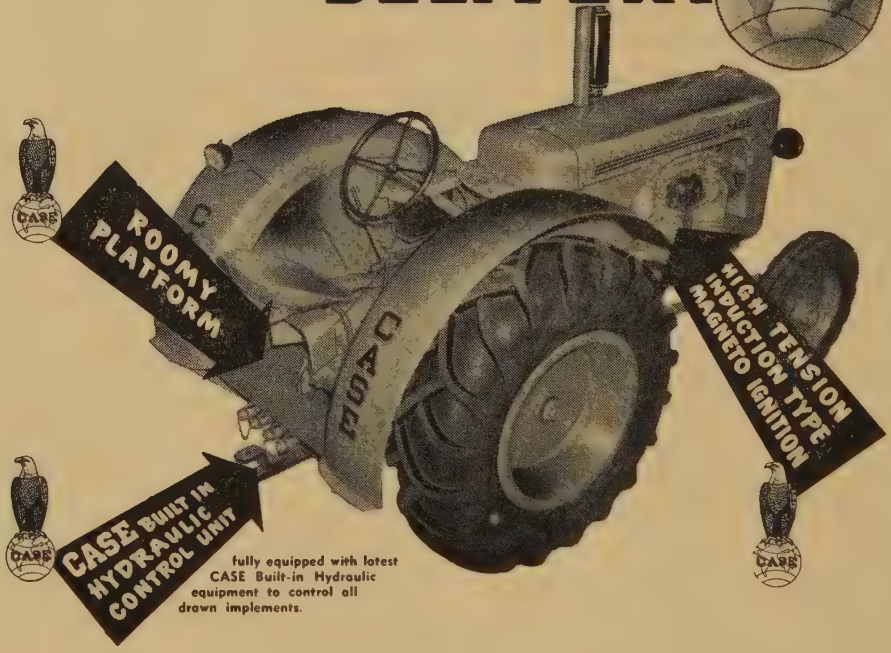
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owing to the hardness of its seeds, requires considerable moisture for successful germination. Because of this, the first seedlings will usually be found in depressions, wheel-tracks and other spots where water lies for some time after showers. The plant is therefore likely to be most common during those seasons which open with good rains, and in which a good season is experienced. In dry seasons the germination even if good, may not be followed by active growth, since, under dry conditions the plants wilt and die. Such was the case along the Fitzroy River in early 1952, when feeding trials had to be curtailed owing to the inadequacy of supplies.

Crotalaria retusa L.
Plant about 20in. tall in flower and with ripe pods. Specimen from tributary watercourses of Fitzroy River at Gogo Station, April 16, 1951.

With suitable opening rains, followed by fairly frequent falls, the seeds germinate and the plants grow freely, and when young are eaten avidly by horses during this season of rapid growth. Later, when the plants are mature, especially when in flower and pod, they are avoided by horses and stock generally.

The plant attains an average height of two or three feet, but plants of four feet are not uncommon. The stems are dark green and more or less ribbed longitudinally, and the leaves are a deep green in colour on their upper surfaces, but paler underneath, with short silky hairs lying against the leaf-surface.

The pea-shaped flowers are rather large, and a strong clear yellow in colour, or with reddish streaks on the standard, and sometimes chocolate-brown on the back. There are usually 12 to 20 flowers in the "spike". The plant flowers in April as a rule, and the flowers are succeeded by pods which are characteristic.

In *Crotalaria retusa* the pods are one to one and a half inches long, and inflated, on short stalks, stalked at the base, and standing upwards and outwards from the stem in a manner which is I think peculiar to this species in Kimberley. The pod is blunt at the end, with a short hook formed from the remains of the style. The seeds,

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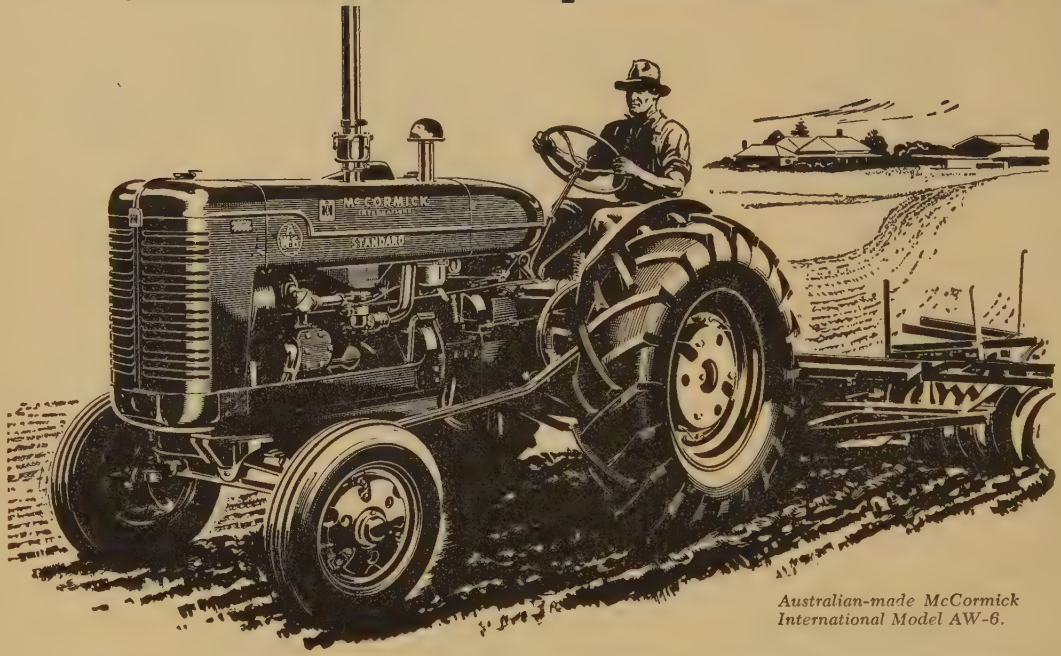

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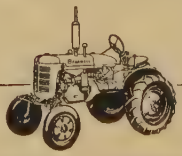

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several in number are yellowish, kidney-shaped, and cause the pod to rattle when pod and seeds are quite ripe, hence the name "rattlepod", from the Greek *krotalon*—a rattle or castanet.

The plant is not evenly distributed. In the course of the botanical surveys made, it was soon discovered that Kimberley Horse Disease was peculiar to areas in which the horse or spell paddocks were adjacent to streams or had streams passing through them—in other words where stock had access to watercourses, usually of considerable size. The *Crotalaria* was most abundant on the larger streams with low banks which were overflowed by early summer rains, such as the Fitzroy River near Fitzroy Crossing, the Lennard River, portions of the Ord River and the Adcock and Hann Rivers. Horse paddocks not so situated, such as those at Moola Bulla, Louisa Downs and Blina were free from Kimberley Horse Disease.

At Moola Bulla the horse paddocks are clustered around Mount Barrett, in high country with small, short watercourses. There is no *Crotalaria retusa* there, but had the horse paddocks been further west along the upper reaches of the Margaret River, where this plant occurs in small numbers, some losses might have been experienced. Similarly at Louisa Downs, where the horse paddock is away from the Margaret River, the losses which have been experienced from Walkabout Disease may be attributed to the presence of horses which had been turned out in spell paddocks on the river flats in the early wet season. This is true also of Christmas Creek, while at Blina, where no case has been reported, there are no watercourses in the horse paddock.

At the same time it must be remembered that horses dying in April may have received their lethal dosage in December or January, or some part of it perhaps during the previous season, so that in all cases of losses, some history of the animals is necessary. Along the middle reaches of the Fitzroy and Margaret Rivers, as well as the middle and lower reaches of the Ord River, losses have been very heavy, for example, at Gogo, Carlton Hill, and Lissadell. Here *Crotalaria retusa* occurs abundantly, and such spots are characteristic for the occurrence of the plant and the disease. In no single instance where the disease has occurred have I found a horse paddock free of *Crotalaria retusa* unless it was shown that the horse or horses affected had been in country where the plant was in active growth while the animal was there.

The plant is not necessarily abundant all along the same stream, for example, while common on the Gogo side of the Margaret River, it is seldom found on the northern bank at Fossil Downs. The only difference between the two appears to be in the geology of the soils.

Other examples of affected areas are those of the Hann, Adcock and Barker Rivers, Fletcher's Creek near Mount Hart, and Fletcher's Creek near Turkey Creek, as well as the Turner River and Turkey Creek. I have not found the plant on higher ground than that which is subject to the average seasonal floods. It is most abundant in the river soils where the river gum *(Eucalyptus camaldulensis)* grows, and where the river plain white gum, "carbeen", or "ghost gum" *(Eucalyptus papuana)* occurs. It is not usually common in coolabah country except on the actual banks of the streams, for it does not appear to favour the heavy clay soils, and it rarely occurs in bloodwood *(E. dichromophloia)* country except on the lower Ord River flats.

The range of *Crotalaria retusa* in Western Australia extends from the north coast southwards to the Fitzroy River and its tributaries—including Christmas Creek. It is fairly common along the Glenelg, Prince Regent and Isdell Rivers, and is found along the Durack River and the upper courses and tributaries of the Hann and King Edward Rivers.

After producing and liberating its seeds the plant dies. This occurs usually in May, June or early July.

PREVENTION

The losses which have occurred have been investigated with reference to horse paddocks only. It appears that most, if not all the damage is caused in the period from December to early March, when the horses are usually in the spell paddocks, and the plants are young and palatable. I have already referred to the common occurrence of horse paddocks adjacent to streams, and to the heavy losses sustained in a number of these where the *Crotalaria* is abundant, while in those in which it is comparatively scarce, such as Fossil Downs, Mount Amherst, Kimberley Downs and others, losses are infrequent. On properties in which the horse paddocks are on higher ground away from the *Crotalaria,* losses appear to be unknown or the areas are said to be entirely free from Kimberley Horse Disease.

Control measures employing the destruction of the plant are entirely out of the question because of the extensive areas involved even in the smaller horse paddocks. The occurrence of the plants among the grasses; the fact that the plants are eaten freely from the seedling stage until well towards maturity, and the wide distribution of seeds by flood waters make eradication difficult or impossible and in any case the destruction of the plants would be a constantly recurring annual treatment.

It is suggested, however, that losses may be avoided by fencing off the areas in which *Crotalaria retusa* occurs, especially the river frontages of horse paddocks, or by establishing new horse paddocks in the higher bloodwood or spinifex areas above the low-lying river levels which are the peculiar home of *Crotalaria retusa.*

Pastoralists are advised to familiarise themselves with the appearance of the plant by a study of the illustrations accompanying this article and to check suspected plants with these and with the printed description.

Some ideas of the distribution of the plants in horse paddocks should then be possible. The history of horse losses should be checked, remembering that losses would tend to be light in dry seasons and heaviest in the good pastoral seasons when rains have been frequent and plentiful.

Where losses have occurred and *Crotalaria retusa* does not appear to be present in the horse paddocks, check other locations on which the horses have been running for several months prior to death, as the effects of eating the plant might not become apparent for some time.

"WALKABOUT DISEASE"

This disease has existed in the Kimberleys since the earliest days of settlement and because of the mortalities it has caused among horses it has greatly hampered station activities. Because of the difficulty of maintaining sufficient horses for mustering, working and handling of cattle, the disease has been a matter of serious concern to pastoralists.

Losses are sustained for the most part during the wet season, but the severity of the disease is subject to considerable fluctuation depending upon seasonal conditions. In some years mortalities have been light and almost insignificant but in others they have reached disastrous proportions.

The clinical manifestations of the disease are variable, but in the majority of cases symptoms of somnolence and constant and aimless walking develop during the late stages and these are followed by coma and death. The mortality rate is high, and in well-defined cases of the disease few, if any, recoveries occur.

At post mortem the liver shows characteristic changes which are now known to result from the consumption of plants containing toxic alkaloids which inflict severe damage upon liver cells. These changes are permanent and irreversible and consequently it is not to be expected that any method of treatment will prove effective.

For this reason it is of the utmost importance that preventive measures should be adopted. Horse paddocks should be located wherever possible in areas known to be free of plants known to be dangerous.

OTHER SPECIES

There are from 13 to 15 other species of *Crotalaria* in the Kimberley Division, some of them being rare while others

are quite common. One species *(Crotalaria trifoliastrim)* is even more widely distributed than *C. retusa*. Just how far these other species are implicated in Kimberley Horse Disease is not known at present but, with the one exception quoted above, the other species do not have the general distribution on river frontages.

BOTANICAL DESCRIPTION

An annual plant usually 18-36 inches tall, but occasionally attaining a height of four feet or more, with an upright stem and branches which are fluted or ribbed, and green in the younger parts.

Leaves mostly opposite or scattered, erect or spreading, simple, on short stalks with two caducous stipules at the base, the leaf one and a half to three inches in length, oblong to wedge-shaped or narrowly elliptical, rarely broadly obovate, obtuse, with usually a small indentation at the top (retuse) and a minute point in the notch or at the obtuse end, dark green and slightly rough on the upper surface, paler underneath with short silky hairs which are pressed against the surface of the leaf (these hairs more conspicuous in the younger than the adult plant).

Flowers in terminal loose racemes of usually about 12-20 blossoms on short spreading stalks, each stalk with a very small bract at the base, and two smaller bracteoles about the middle, but caducous (falling early). Calyx green, 5-lobed, the two upper lobes the longest and somewhat spreading, the three lower short and approximate. Corolla pea-shaped, clear yellow in colour, or sometimes suffused with brick red, or with short reddish radiating lines, sometimes chocolate-brown on the back of the standard, the standard erect and notched, the wings smaller and ear-shaped, the keel also shorter than the standard, and terminating in an acute erect beak-like point. The stamens are ten in number, united about half way up into a sheath open on the upper side, the anthers alternately narrow and smaller and broader.

The pod if oblong in shape, without any hairs, often one and a half inches long, broadened upwards, blunt or rounded at the extremity with a short beak-like point, brown or purplish-brown when ripe, very turgid or inflated, the base of the style remaining as a terminal hook. Seeds usually 8-15, yellow kidney-shaped, hard and shining.

Native to the tropical regions of the Earth, and found in America, Africa, Asia and Northern Australia. The generic name *Crotalaria* is derived from the Greek *Krotalon* —a rattle or castanet, in reference to the ripe seed rattling in the inflated pods of most species; *retusa* refers to the small indentation at the top of the typical leaf.

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GIMLET TREES (Eucalyptus salubris F. Muell.)

TREES OF WESTERN AUSTRALIA

By C. A. GARDNER, Government Botanist

Nos. 7 and 8—THE GIMLET TREES (*Eucalyptus salubris* F. Muell. and *E. campaspe* S. Moore)

NEXT to the salmon gum, the gimlet tree is perhaps the best-known of the trees of the Eastern Agricultural Districts and the Eastern Goldfields. A thin reddish-brown bark, and a fluted or spirally-twisted trunk (especially in the young trees), distinguish at a glance the gimlet trees or fluted gums from all other Eucalyptus trees. This bark has a thin outer layer which when removed reveals a sappy pale green, inner bark, and sometimes this inner green bark is exposed when the trees shed their reddish-brown outer bark towards the end of summer.

The bark is "clean" and smooth throughout, although occasionally there remain pieces of ribbony bark persisting at the base of the trunk.

The timber is pale brown, straight-grained and very strong and durable, and for this reason, as well as for the fact that the young trees, especially when growing close together, have slender straight trunks, they are sought after for rails and for poles. The timber is not termite-resistant, and the older trees are frequently hollow as a result of termite infection.

The presence of gimlet trees is an indication of good loamy soils, often with a large proportion of clay, and the tree usually occurs with the salmon gum, forming open woodland. When they grow separately, it is usually found that the gimlet trees inhabit the heavier soils. Salmon gum and gimlet country is usually regarded as being first-class country for wheat-growing.

There are two distinct trees called gimlets, the common gimlet *(Eucalyptus salubris)* and the silver-topped gimlet *(E. campaspe)*. The former enjoys a wide range—extending from the Mullewa and the Mount Gibson country near Ninghan eastwards to the north of Kalgoorlie; southwards through Dowerin and Cunderdin as far south as Lake Grace, and eastwards to Ravensthorpe and Salmon Gums. Its eastern extremities are found as far inland as Ularring and Queen Victoria Spring, always occurring on low lying areas, frequently in association with the salmon gum.

The silver-topped gimlet on the other hand, is confined to the Eastern Goldfields, and is recorded from the Bullabulling and Coolgardie districts to as far south as Higginsville. The two trees are very closely related, and in their appearance and floral structure the essential differences between them are restricted to the smaller branches and twigs, the leaves and the anthers. In the common gimlet the branchlets are reddish and shining, the leaves of a deep lustrous green, and the anthers broad. The fruits are usually small.

In the silver-topped gimlet the smaller branches and twigs are covered with a white powder, giving them a silvery or frosted appearance. The leaves are a pale bluish green (glaucous), anthers

EXPLANATION OF PLATE

A—G. THE COMMON GIMLET (Eucalyptus salubris F. Muell). A, branchlet with leaves and buds. B, anther. C and D, fruits. E, fruit in longitudinal section. F, seeds. G, expanded (seedling) cotyledons.

H—L. THE SILVER-TOPPED GIMLET (Eucalyptus campaspe S. Moore). H, branchlet with leaves, buds and fruits of the Higginsville form. I, branchlet with buds and fruits of the Coolgardie (Montana Hill) form, also K, buds and L, anthers of the Coolgardie form.

—Icon. origin.

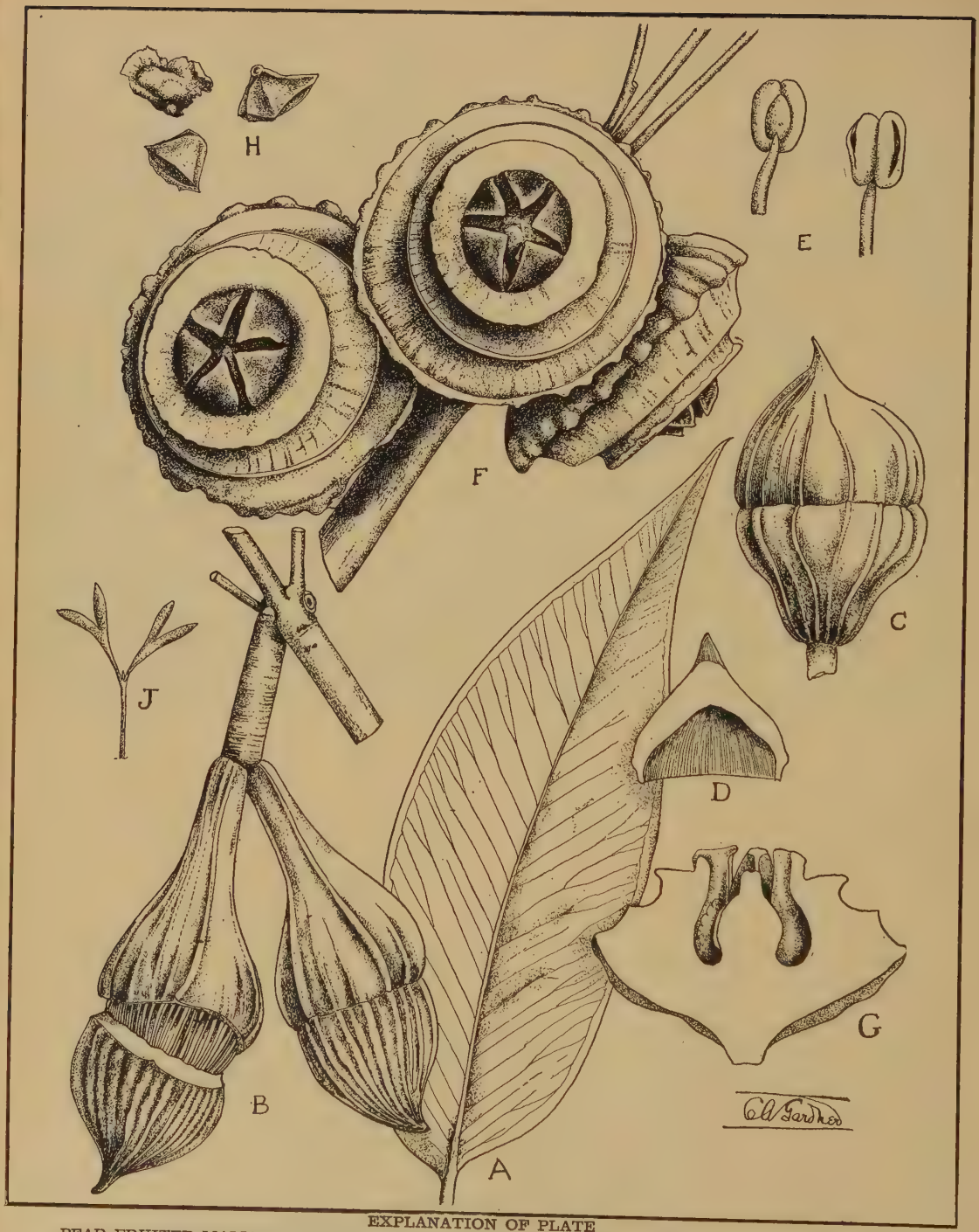
SILVER-TOPPED GIMLET (Eucalyptus campaspe S. Moore)

long and narrow, and the fruits typically larger. The trunk, bark and branching habit of the two are similar.

The common gimlet was named *salubris* by von Mueller because of what he termed its "sanitary importance"—its health-giving properties, ascribed to what he regarded, from its very numerous oil-glands, as a high yield of eucalyptus oil. Examinations of the oil made by Baker and Smith from trees grown in the Hine's Hill district have scarcely confirmed this, the yield being 1.4 per cent., and the cineole content of the oil 10 per cent., with much cymene and high boiling aldehyde. Further examinations from other trees and districts may result in a higher production of oil, as is the case with the salmon gum.

The bark is rich in tannin, containing up to 18.6 per cent. When dry it is very friable, and its action as a tanning agent is said to be rapid. The native name of the common gimlet is given as Gnardarup.

The silver-topped gimlet is named *campaspe* from the fact that on the Eastern Goldfields it grows on plains or level stretches of soil. Variations in its oil-yield are rather interesting. Trees from Widgiemooltha gave a yield of 0.72 per cent., with a cineole content of 15 per cent.; alcohols about 20 per cent., and the oil of a terpene type. Trees from Gibraltar on the other hand gave an oil of what is probably a pinene type; a yield of 1.2 per cent., and a cineole content of 64 per cent., with alcohols 10 per cent. These two forms are illustrated, the Higginsville plant (near Widgiemooltha) shown in figure H, while the Coolgardie (Gibraltar ?) form



EXPLANATION OF PLATE

PEAR-FRUITED MALLEE (Eucalyptus pyriformis Turcz.).—A, leaf. B, buds. C, bud of the typical form. D, operculum in longitudinal section. E, anthers. F, clusters of fruits of the typical form. G, longitudinal section of the fruit. H, seeds. J, cotyledons (seed-leaves).

—Incon. origin.

is shown in figure I. There are distinct differences between the two, and the species require further investigation, both botanically and chemically.

Both trees are eminently suitable for planting, in parks, in gardens, and as street trees. Trees planted in Tammin are proving very successful as street trees. They are also suitable for windbreak and shade purposes.

DESCRIPTION OF THE SPECIES

1.—COMMON GIMLET (Eucalyptus salubris F. Muell.)

A tree 60 to 80 feet tall, attaining a diameter of 30 inches, and a trunk up to 50 feet long, but usually much smaller, the branches erect, usually slender. The trunk of the young plant is typically fluted or spirally twisted, but this is not always the case, and old robust trees usually have a smooth cylindrical trunk. Bark thin, smooth, greenish-red or reddish-brown, shining. Timber pale, hard and dense, strong, with a narrow white sapwood. Leaves alternate, petiolate, erect, narrow-lanceolate, shining on both surfaces, deep green, acute or attenuated into a long hooked point, the midrib narrow and conspicuous, the lateral nerves not very distinct, making a rather wide angle with the midrib, the intramarginal nerve close to the leaf margin. Flowers in axillary umbels, the peduncle more or less flattened, rather long, or sometimes short, bearing 4-7 flowers on slender pedicels. Calyx-tube obovoid to hemispherical, smooth; operculum ovoid to almost cylindrical, smooth, usually red in colour and obtuse. Stamens numerous, the filaments inflected in the bud; anthers white, opening in longitudinal slits. Fruit obovoid to hemispherical, often slightly 2-angled, with a narrow convex rim or disc, and prominently exserted deltoid valves typically four in number. Seeds minutely fringed.

2.—SILVER-TOPPED GIMLET (Eucalyptus campaspe S. Moore)

A slender tree 25 to 35 feet tall, with the typical appearance of the common gimlet, but the upper parts of the branches and the branchlets covered with a white powder. Leaves petiolate, alternate, erect or spreading, usually broader than those of Eucalyptus salubris, and blue-green in appearance—never deep green and lustrous. Flowers in axillary umbels, the peduncles usually short and broad, and the flowers almost sessile, the whole inflorescence powdery-white; calyx-tube hemispherical to shortly obovoid; operculum conical to hemispherical, rarely longer than the calyx-tube, smooth. Stamens numerous, the white filaments inflected in the bud; anthers versatile, rather narrow, opening in parallel longitudinal slits. Fruit hemispherical to obovoid-turbinate, 7-10mm. long, the disc flat, the valves (usually four) broadly deltoid and exserted. Seeds unknown.

No. 9—THE PEAR-FRUITED MALLEE

(*Eucalyptus pyriformis* Turcz.)

THIS species, named by the Russian botanist Turczaninow, takes its name pyriformis from its pear-shaped buds. It is a shrubby eucalypt, and hence a mallee, rarely exceeding 12 feet in height, with a rough bark and smooth stout branches, often of a shining red colour. The leaves are alternate rigid and erect, thick, pale grey-green on both surfaces, and ovate-lanceolate to lanceolate in shape, the midrib conspicuous, the lateral nerves only moderately so and diverging from the midrib at a wide angle, the intramarginal nerve distinctly removed from the leaf-margin.

The oil-glands are concealed, but numerous. Flowers very large, usually two or three together on thick recurved peduncles, very rarely solitary, the pedicels robust, as long as or longer than the calyx-tube or sometimes shorter, rarely the flowers without pedicels. Calyx-tube from obconical (i.e., conical but attached by the apex) to depressed-hemispherical, with several longitudinal ribs; usually pale or glaucous in the bud; operculum hemispherical to shortly conical, usually beaked, longitudinally ribbed, but usually less markedly so than the calyx-tube, very thick and with a broad base. Stamens numerous, long, the filaments yellow, pink or red, inflected in the bud; anthers oval in outline, versatile (attached above the base) opening in longitudinal parallel slits; style thick and straight. Fruit very large (4-7cm. diameter—i.e., 2-3 inches), varying in shape from elongated obconical to depressed hemispherical (the latter illustrated on Plate II), strongly and irregularly longitudinally ribbed, either tapering into the pedicel at the base, or when broad almost sessile (stalkless), the disc very broad, abruptly raised above the rim, and depressed in the middle; capsule 4-6-valved, the valves broadly deltoid and not exserted. Fertile seeds more or less pyramidal, and winged on the margins, dark brown or black; sterile seeds very narrow. Cotyledons bifurcated.

The species occurs in poor sandy country over a wide expanse of country. From the lower Murchison River in the north it extends southwards to near Watheroo, and eastwards to the Eastern Goldfields as far as Queen Victoria Spring, and northwards to Leonora. The

typical form has short pedicels and a short calyx, but the common form from the Goomalling-Dowerin district, called the "Dowerin Rose"—the variety *elongata*—has elongated buds tapering into a long pedicel.

It is suitable for planting in parks and gardens, being exceptionally hardy and among the most decorative of all the species of *Eucalyptus*. It is always a shrub and does not produce a large bulbous stock, but remains shrubby, branching from the ground. It yields an oil of the cineole-pinene-eudesmol type. With a yield of 1.1 per cent., the cineole content being 56 per cent.

Already common in certain parks, this species should be more extensively planted in the agricultural areas, especially in areas free from frost. Its floriferous habit and large blooms promise well for its value as a pollen and nectar producer, and it should be of value to the apiarist. In the size of its blossoms it is little smaller than *Eucalyptus macrocarpa*, and where the latter thrives, *Eucalyptus pyriformis* should succeed.

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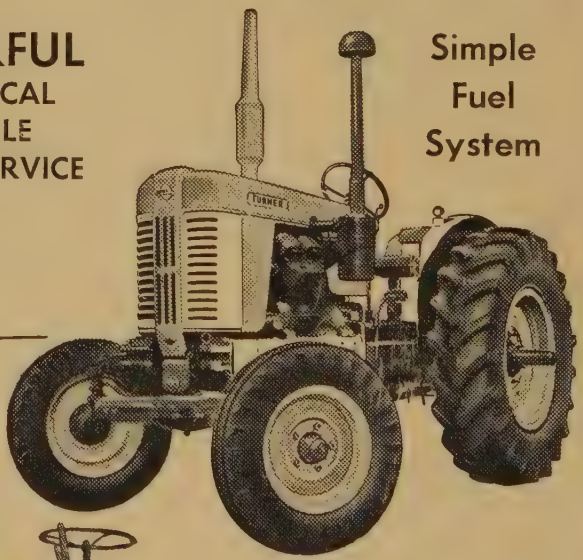

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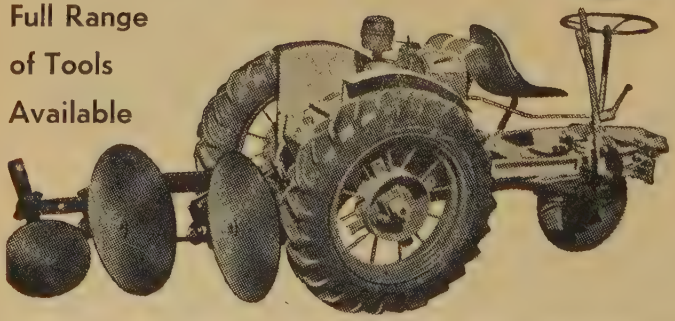

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THINNING OF DECIDUOUS FRUITS

By F. MELVILLE, B.Sc. (Agric.), Acting Assistant Superintendent of Horticulture
and T. F. HERLIHY, Senior Horticulture Instructor

IN the absence of any artificial control of the crop, most varieties of fruit trees will set much more fruit than it is possible for the trees to bring to marketable size and this is particularly the case with stone fruits. Even under good cultural and weather conditions the trees are often unable to bring the fruit to satisfactory size unless thinning is practised.

Apart from damage to the tree by the breakage of limbs and the over-taxing of its resources, overcropping results in the production of a large proportion of small fruit, which besides embarrassing the grower by increasing the work and cost of picking, grading and packing, often brings a return considerably below the costs of production. This is particularly evident in a heavy crop year when small poor quality lines may be almost unsaleable. At the same time, however, buyers will usually pay good prices for fruit of good size and quality.

Fig. 1.—THINNING DELAWARE PLUMS—Note fruit on ground. In a heavy crop year up to 75% of the fruit may need to be removed in order to enable the remainder to develop satisfactorily

THIN EARLY

The size of the crop can be controlled only partly by winter pruning, but from the point of view of reducing the strain on the tree by overcropping and minimising the associated disability of biennial bearing, early thinning is essential. Thinning can be accomplished by the physical removal of surplus fruits when setting is completed or the blossoms can be sprayed with chemicals to achieve similar results. The use of blossom-thinning sprays is practised elsewhere, and experiments are being conducted in this State; however at the present time no definite recommendations can be made.

After setting has taken place and the natural drop which follows is over, the grower can obtain a fairly accurate picture of the forth-coming crop. At this stage, thinning can be used effectively to reduce the quantity of fruit on each tree, to a number which can be brought up to a satisfactory size under normal weather conditions.

Successful thinning is based on a knowledge of local conditions. Having in mind the size of fruit required and normal moisture resources, the thinner must be able to visualise the amount of fruit each tree and each part of the tree is capable of carrying. Certain vigorous growths may be able to carry extra fruits, whereas some weak shoots may not be capable of maturing any. Each fruit must have sufficient room to grow, and best results will be achieved by spacing as evenly as possible over the whole tree; this applies also when the fruit on a light crop tree sets in clusters.

DISCARD BLEMISHED FRUIT

Thinning provides an excellent opportunity to discard fruit which is misshapen, blemished or damaged by insect pests or disease. Rejections can be made more cheaply at this stage than after deliveries have been made to the packing shed when the costs of picking and sorting have been incurred.

The earlier the thinning is carried out, the greater will be the effect on the remaining fruits and on blossom bud formation for the following year, but the most practicable time for this operation is when the natural drop has finished.

The quantity of fruit to be removed from fruit trees during the operation of thinning varies considerably. Some growers thin much more heavily than others but it is safe to say that trees are rarely overthinned. It is often necessary, particularly with Japanese plums, early apricots and some varieties of apples, to remove over 75 per cent. of the fruit. At the time it appears that excessive quantities of fruit are being removed and growers usually err on the side of under-thinning.

Generally speaking, at harvest time the volume of thinned fruit may be slightly less than the unthinned fruit. Nevertheless the difference is not very great and the improvement in quality, reduced handling costs and enhanced returns more than compensates for the reduction in quantity.

When removing the fruit, care should be taken not to damage those remaining. Each should be dislodged by a twisting and bending motion of the

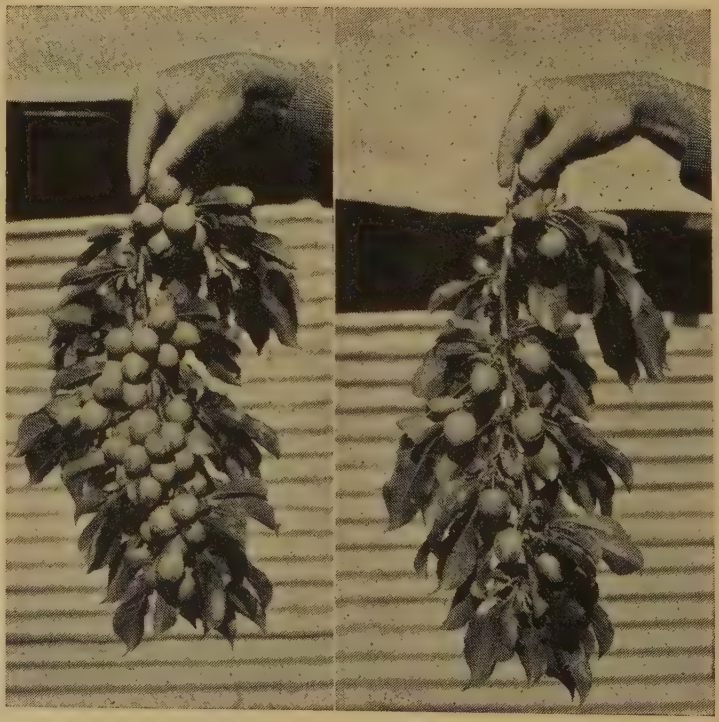


Fig. 2.—SATSUMA PLUMS—On left a lateral showing heavy crop. On maturity, such fruit would be undersized and probably of little value. At right, the same lateral thinned to show the reduction in number and spacing of the fruit

thumb and forefinger and not just pulled off. In the case of clusters, care should be taken to allow the stem remnants to remain. If they are loosened at their points of attachments to the spur or lateral those left may fall later. Thinning snips can also be satisfactorily used.

STONE FRUITS

The thinning of stone fruits should be carried out before stone hardening commences. Because of the heavy crops that stone fruits often carry, they respond very readily to thinning. The amount of fruit removed will depend upon the various factors enumerated previously and it is therefore, difficult to suggest a limit. However, it is generally found that for average trees, peaches should be thinned to leave at least six inches between fruits except where the variety normally produces large fruits. For smaller fruits, such as apricots and plums, closer spacing is possible and for most varieties four inches is usually ample.

Fig. 3.—ROWE'S SLIP PEACH—The market is selective and high prices are paid for good quality fruit. Thinning is a necessity for the lateral on the left. Right, shows same after thinning.

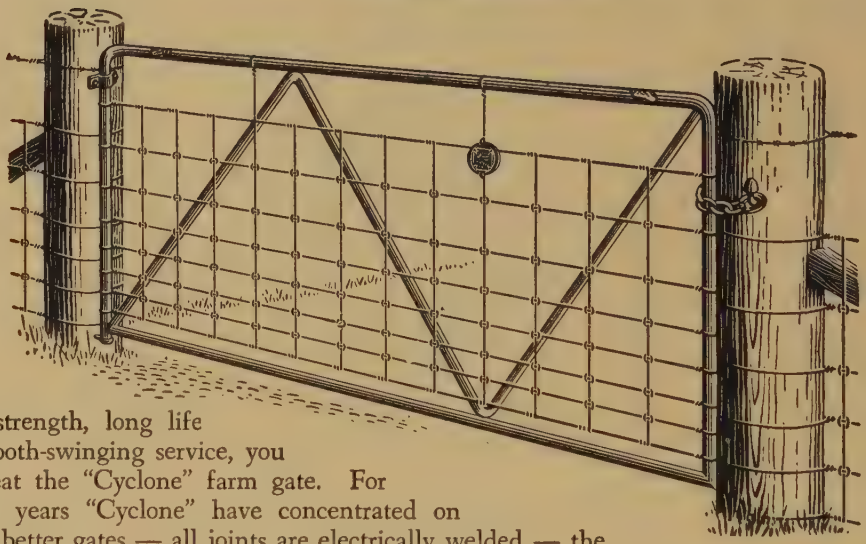
Fig. 4.—YATES APPLES—Unthinned on left. Even with light crops it is advisable to thin out clusters. The removal of the "Bull" apple permits better selection of the remaining fruit. At right, the clusters have been reduced to twos to allow optimum fruit development

APPLES

Thinning is necessary for most varieties of apples although, where adequate irrigation is available, much less thinning is required and is usually restricted to short-stemmed varieties.

The individual grower knows by past experience how his trees will react to the conditions operating on his own orchard and will thin accordingly. The pro-

There's nothing to match a genuine Cyclone gate



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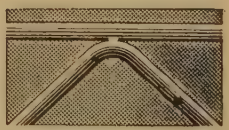
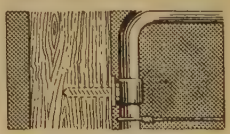


Frame and cross members are welded into one solid unit.



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FIELD GATES

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Fig. 5.—DOUGHERTY APPLES are shown at left before thinning. At right they have been reduced to ones and twos and spaced to ensure maximum development

cedure will however, vary with the variety.

Short Stemmed Varieties.—On short-stemmed varieties such as Jonathans, Rokewoods, Statesmen, Delicious, and Dunns the sooner the work is completed the better as, with growth, the clusters become tight and difficult to break successfully.

Under favourable conditions it is usual for these varieties to set up to five apples on each spur and, unless the individual clusters are thinned, a large proportion of the crop is lost through being undersized and through being pushed off.

Usually the centre apple which is referred to as the "Bull" or "King" is the first one thinned from the cluster. By removing this apple first the operator can then observe any blemished or malformed ones which can then also be removed and the remainder evenly spaced.

It is well to remember that short-stemmed varieties require more room for development than the longer-stemmed varieties and the apples must be spaced in such a way as to allow for expansion without crowding. The clusters are usually reduced to ones and twos and spaced approximately four inches apart.

Cleopatras.—During recent years Cleopatras, a medium-stemmed variety, have set in threes, twos and ones and very little thinning has been necessary. In heavy crop years Cleopatras should be thinned to twos and threes. However care should be taken with this variety not to reduce the crop to such an extent as to induce Bitter Pit.

On account of the spreading nature of the tree and the susceptibility of the variety to sunburn, care should be taken to ensure that the work is completed before the hot weather sets in, otherwise sunburn damage may occur on apples, exposed by the removal of apples protecting them.

Granny Smiths.—It is characteristic of the Granny Smith apple to "shed" or drop portion of its fruits over a con-

siderable period. Sometimes a final shedding may occur as late as December; it is thus preferable to delay thinning of this variety until shedding is finished. Under heavy crop conditions the fruit should be thinned to twos on spurs spaced approximately four inches apart.

Yates.—This late apple usually sets very heavily, and is perhaps the variety which responds most to early thinning. The fruit, except where grown under irrigation, should be thinned to ones and twos.

Unthinned, the variety rarely makes minimum size and financially can become a liability to the grower. On the other hand, a thinned crop, containing a large proportion of 2½ inch with some 2¼'s and 2¾'s can bring very attractive prices.

SUMMARY

Thinning Pays Dividends

1. Early thinning is necessary in heavy crop seasons to produce good quality fruit. Unthinned the crop may be worthless.

2. In light to medium crop years, clusters should also be thinned.

3. The work should be commenced immediately the natural shed is over. With stone fruits before stone hardening commences.

4. The fruit should be evenly spaced bearing in mind normal weather, moisture and cultural conditions. Vigorous laterals and spurs can carry more fruit than weak ones.

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SYDNEY.

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INSECT Pests AND THEIR CONTROL

by C. F. H. JENKINS, M.A., *(Government Entomologist).*

APHIDES

THE members of the aphis family are remarkable creatures both in structure and habits. They are practically world-wide in their distribution and despite their small size and apparent fragility they thrive under a wide variety of conditions and are among the most prolific breeders in the animal kingdom.

All the pest species in Australia have been introduced from other parts of the world, and there are only a few rare forms actually native to this continent. The introduced species, however, have thrived so well that they can be counted among the most serious pests with which the gardener and horticulturist have to contend.

Although one species of aphis will often attack quite a wide variety of hosts, generally a single species or group of plants is favoured, thus the different species are known as cotton aphis (*Aphis gossypii* Glov.); cabbage aphis (*Brevicoryne brassicae* (L.)); green peach aphis (*Myzus persicae* (Sulz.)); rose aphis (*Macrosiphum rosae* (L.)); strawberry aphis (*Capitophorus fragariae* (Theob.)); black citrus aphis (*Toxoptera aurantii* (Boy)); according to the particular plant usually attacked.

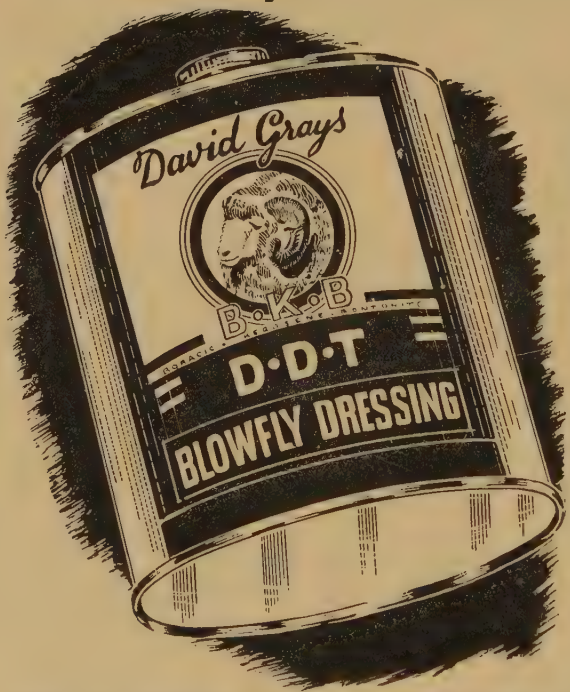
On account of their delicate structure aphides do not thrive under extreme conditions of heat or cold, neither do they like heavy rain. This accounts for the fact that in most districts it is mainly in the spring and autumn that heavy aphis plagues appear. No one can observe the occurrence of a severe aphis infestation without marvelling at the astounding rapidity with which the creatures reproduce. This rapid rate of reproduction renders the aphis a particularly difficult insect to combat and means that control measures must be very thoroughly applied if rapid re-infestations are not to occur.

GENERAL DESCRIPTION

Although differing in size and colour according to species, aphides, often known as plant lice, can be easily recognised by their soft delicate structure and other characteristics. They are sluggish in their movements, have rather long legs, and are usually found clustered on the host plants. The wings when present are clear. The abdomen is usually rather swollen and often carries a pair of horns or cornicles from which a sweet honey-dew much prized by ants is excreted.

The mouth parts are produced into a long thin sucking tube, rather like the proboscis of a mosquito, and by means of this thin tube the plant tissue is pierced and the sap imbibed.

CONTROL
Blowfly Strike—



USE

B.K.B
D.D.T
BLOWFLY DRESSING

With every succeeding season Sheep Farmers find that there is only one Blowfly Dressing to use —David Grays B.K.B.-D.D.T.

This efficient dressing scores over all others, because in rapidly killing the maggots it not only prevents them from crawling on to near-by areas and re-establishing themselves there, but it so affects them that even if they are able to drop off the sheep they cannot complete their development into flies.

Before using B.K.B.-D.D.T. shear the struck area of the animal to ensure that the full extent of the strike is exposed, and pour on sufficient of the Dressing to saturate the whole area thoroughly; the most satisfactory method to ensure thorough penetration is by lightly dabbing in B.K.B.-D.D.T. with the hand or brush.

David Grays Blowfly Dressing is non-irritant and contains D.D.T. in sufficient strength to safeguard the sheep against restrike and is absolutely 100 per cent. reliable to kill all flies coming in contact with the dressed animals.

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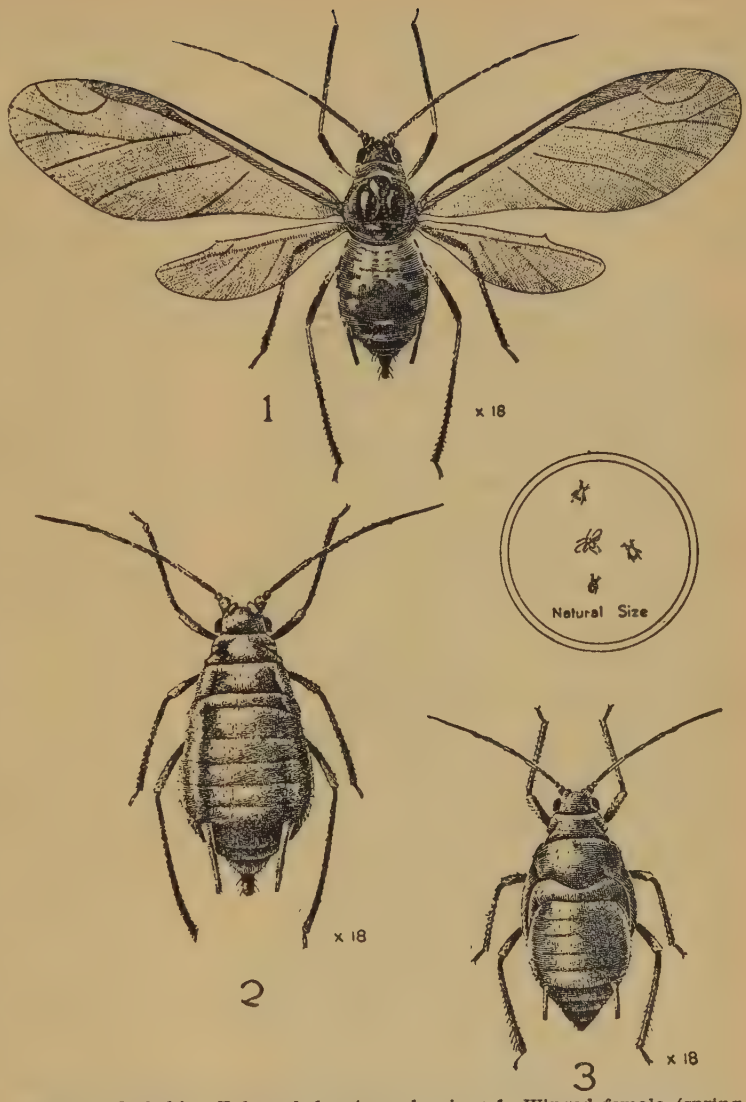
This method of feeding should be carefully noted for it is a knowledge of an insect's feeding habits and mechanism that is most essential in determining control measures.

LIFE HISTORY

In order to understand how the remarkable rate of reproduction is accomplished it is necessary to have a detailed knowledge of the general life history of the aphis. After examining a cluster of aphides on a rose or cabbage leaf, one will notice that all the insects are not identical. Some are larger than others, some are winged and some are wingless.

The large wingless ones are known as stem-mothers. They are females capable of giving rise to living young without having previously been fertilised. The power to reproduce in this manner is known as parthenogenesis. The young from these parthenogenetic stem-mothers grow rapidly and in a few days can in turn produce more living young. Every now and then, winged females are developed, and have the same unusual reproductive powers as their wingless parents. These fly to other plants and so spread the infestation.



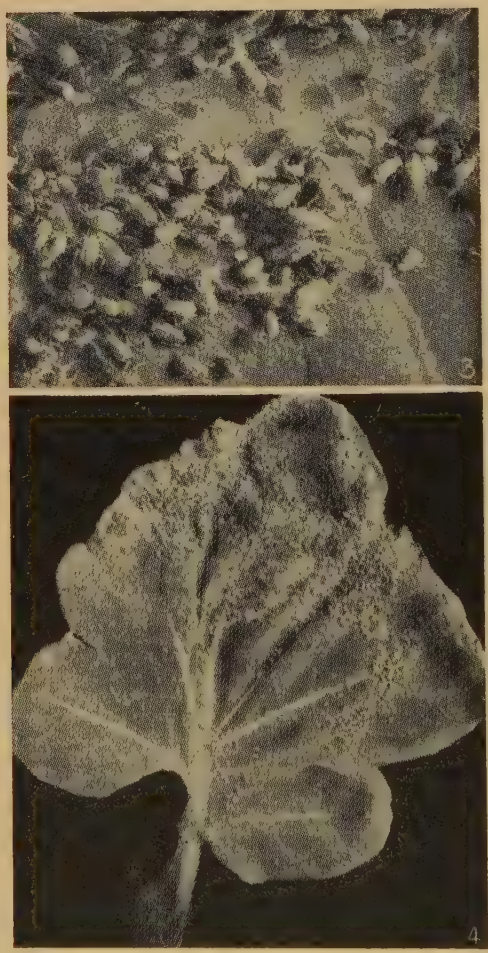
Green Peach Aphis.—Enlarged drawings showing: 1—Winged female (spring form). 2—Wingless female. 3—Nymph or immature winged female. After E. H. Zeck.

In cold countries, as winter approaches, male and female aphides are developed, and fertilised eggs are laid on the host plants. These eggs last over the winter and give rise to stem-mothers next spring.

In Western Australia it is doubtful whether the weather is ever severe enough to bring about egg-laying, and the insects carry over from one season to another by means of the few females which survive in sheltered spots.

The life history of many aphides in Europe is complicated by the inclusion of alternate host plants into the cycle, or by a migration of the population to a

subterranean life on the roots. Two local species the black peach aphis (*Anuraphis persicae-niger* (Smith)) and the woolly aphis (*Eriosoma lanigerum* (Housm.)) have root-infesting forms but the relatively simple life history of most Western Australian aphides can be attributed to the mild climate of this State.



Colonies of aphides on cabbage leaf.
—Photo., U.S. Dept. of Agriculture

CONTROL

Due to the fact that the aphis is a sap-sucking insect and that it does not actually eat the foliage, ordinary poisonous sprays and dusts are useless as controls. On account of the insect's soft and delicate structure, however, contact insecticides are very effective.

Sprays.—The chemical most widely used against aphides is nicotine, usually sold under the name of Nicotine Sulphate or "Black Leaf 40." In using nicotine sprays it is essential to add a spreader and activator such as soap or white spraying oil and to apply the spray at a high pressure. Nicotine will give the best results when used on a bright sunny day.

The formula recommended for general use is given below. The quantities shown in brackets are those which may be conveniently used by backyard gardeners or others who only require small quantities of the spraying solution.

Nicotine Sulphate	1¼ pints (2 teaspoonfuls)
White Spraying Oil	1 gallon (3 tablespoonfuls)
Water	100 gallons (1 gallon)
Soap	4 pounds (1oz.) may be used instead of white spraying oil.

When citrus and other hardy trees are requiring treatment the White Oil strength may be increased from 1:100 to 1:40. Such a concentration will also prove effective against most scale insects found infesting oranges and lemons.

Dusts.—Where it is impracticable to spray, dusts containing nicotine and derris have been used with good results.

Two mixtures once very popular were:—

(1)	Nicotine Sulphate	1 part
	Slaked Lime	16 parts
(2)	Tobacco Dust	1 part
	Slaked Lime	1 part

New Insecticides.—Under this heading may be grouped DDT, Benzene-hexachloride (BHC) or Gammexane, HETP or "Hexone" (Hexaethyltetraphosphate), Parathion or E.605 ("Folidol" and "Phosphone") and the systemic insecticides.

Of the list outlined "Hexone" and Parathion are probably the most generally useful against aphis, although all

are effective against some species. Concentrations of 1 part to 1,600 parts of water have been widely recommended but it is usually desirable to follow the dilution rates recommended by the manufacturers as the amount of active ingredients may vary with different brands.

The use of DDT for aphis control is not to be recommended except under special circumstances as the insecticide kills many useful parasites and may lead to an increase in some scale insects and mites. Where for any reason DDT is desired for aphis control, emulsion types are recommended. Several workers have reported them superior to the wettable powders and the concentration suggested is 0.1%.

A combination of insecticides particularly useful to market gardeners is a dust consisting of 2% DDT and 2% BHC. The former satisfactorily controls chewing insects such as cabbage caterpillars and the BHC reduces the aphis population.

"Hexone" and Parathion were both deevloped during the war to alleviate a world shortage of nicotine sulphate and have proved most effective substitutes for the tobacco extract. The insecticide group (organic phosphates) to which "Hexone" and Parathion belong is very toxic to the higher animals and so must be used with great caution. Gloves should be worn when mixing the sprays to prevent any concentrates coming into contact with the bare skin. When spraying, precautions should be taken to see that the spray mist is not inhaled and that clothing does not become saturated with spray liquid. Although a very effective contact insecticide, "Hexone" has little residual effect and the toxicity of the mixture deteriorates rapidly once it is diluted and exposed to the air. Parathion on the other hand has an appreciable residual action and also some of the properties of a systemic insecticide. This renders Parathion the more dangerous of the two preparations and means that it should not be applied to fruits or vegetables later than a month before picking.

Black peach aphides on peach shoot.
—Photo., British Ministry of Agriculture

The systemic insecticides depend for their efficiency on the fact that the materials enter the sap stream and accumulate in the vigorously growing portions of the plant. Systemic materials may be sprayed on the foliage or watered around the roots. They are extremely selective in their action and, of course, only affect sap-sucking insects.

This is of great importance as it allows ladybirds and wasp parasites to go unmolested and continue their work of scale and aphis control.

Young peach leaves showing the characteristic curling and distortion caused by aphides feeding on the under-surfaces.

The use of "systemics" is still largely in the experimental stage. At the present time none is commercially available locally and many of those in use overseas are very dangerous to humans and can be used only with special protective clothing and other precautions.

Biological Control.—There are many excellent examples of the biological control of aphides. Ladybirds feed readily upon most species, and a number of tiny wasps lay their eggs into and develop within the aphis. The cabbage aphis is one variety largely controlled by a wasp parasite introduced into this State in 1907 by the late Mr. George Compere.

The parasitised aphides may be distinguished from the healthy insects by their bloated appearance and light colour, and later by the tiny hole in the back from which the wasp has emerged.

Cultural Methods.—All weeds likely to harbour aphis should be destroyed and especial attention given to weeds closely related to the crop being grown. For instance, wild radish and wild turnip will harbour cabbage aphis, and may easily be responsible for starting an outbreak in a commercial crop.

When cutting cabbages and cauliflowers the whole plant should be destroyed, so that the butt is not left to breed further pests. Similarly when any crop is finished the old plants should be got rid of as soon as possible, for carelessness in this direction leads to the dissemination of diseases and insect pests of all kinds.

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We suggest that the Journal is worth keeping and that a year's issue will make an attractive and useful volume for your library—a volume that is full of sound factual information, attractively presented.

Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.

PLANT DISEASES

LETTUCE MOSAIC

By H. L. HARVEY, B.Sc. (Agric.), Senior Plant Pathologist.

PRELIMINARY surveys of metropolitan market gardens during July and August showed that the virus disease known as lettuce mosaic was present in amounts varying from one to 90 per cent. If not checked it is likely to become one of the most serious diseases of local winter lettuce crops.

The spread of lettuce mosaic may occur by means of infected seed or by aphides which carry the virus from diseased to healthy plants. Other recorded hosts are peas, sweet peas and weeds such as groundsel and prickly sow thistle.

Symptoms.—The most obvious symptom is a mottling of leaves on which the normal green colour is interspersed with areas which are white to yellow in colour especially along the veins (see Figure 1). The effect may be one of green blisters on a pale background and is seen more readily when viewed against the light. This mottling may be very noticeable or just barely perceptible on affected plants. In addition, wrinkling of the leaves tends to be more pronounced than in healthy plants. Mosaic-infected plants may be completely dwarfed if early infection occurs, or partially stunted if infection occurs at later growth stages. Poor development of hearts is often a result of mosaic infection. The loss to the growers is therefore that much of the crop is either unsaleable or can only be sold as low grade lettuce.

Control.—On a basis of observations made to date under local conditions and on general principles, the following control measures are recommended:—

(1) As seed saved from mosaic-infected plants may carry the disease, growers intending to raise their own seed should select mosaic-free lettuce for the purpose. Cases are known where seed has been saved by growers from plants showing mild symptoms because they were considered attractive.

(2) Where transplanting is practised, seedlings should be dipped in a nicotine sulphate solution to destroy aphides just prior to transplanting. (1oz. nicotine sulphate, 2½oz. soft soap, 5 gallons water.)

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Left.—Mosaic-infected lettuce leaf showing pronounced vein-clearing and the presence of green blister—like areas between the pale-coloured veins. Leaf wrinkling may become very exaggerated and affected plants may fail to form compact hearts or may remain partially or completely stunted. **Right.**—Healthy lettuce leaf

(3) Frequent applications of aphis-controlling insecticides to the crop, especially during the early stages of growth will help to prevent infection. (See article on aphides in this issue.)

(4) Remove and destroy mosaic-infected seedlings or plants as soon as the symptoms are noticed.

(5) Weeds in the vicinity of lettuce beds should be kept down to reduce the aphis population and destroy possible weed hosts of the disease.

(6) Where successional plantings are practised, the new planting should be made as far away as possible from the older ones, so as to reduce the chances of spread of the disease by aphides from one planting to the next. For the same reason old beds should be ploughed in as soon as cutting is finished.

FREE SERVICE TO FARMERS

Do you know that the Department of Agriculture provides a free and comprehensive service of advice and technical assistance to farmers.

The Department of Agriculture is at all times ready to assist you with your farming problems and has a number of informative bulletins available covering most phases of agriculture. These are supplied free of charge on application to the Department of Agriculture, St. George's Terrace, Perth.

Specialist officers are at your service at all times, and where necessary they will make personal visits to your property to assist with on-the-spot advice—all without cost to you.

Drop a line to the Department whenever you are in need of advice.

MURESK AGRICULTURAL COLLEGE

Memorial to Foundation Principal

A LARGE gathering of past and present students and members of the staff attended a ceremony at Muresk Agricultural College on Visitors' Day, September 7, when a handsome gateway erected to the memory of Mr. Hugh Jason Hughes the first Principal of the College was officially opened by his widow.

Mr. Hughes, who had a long record of achievement in the educational sphere prior to his Muresk appointment became Principal when the College was founded in 1926. He retired in 1938 and his death occurred three years later.

A strict disciplinarian and an able administrator, Mr. Hughes had the gift of commanding both respect and affection. Always ready to help any student who was a trier he laid the foundations of many enduring friendships in the 12 years that he was in charge of the College. Although his previous experience had been confined to the scholastic, rather than the agricultural sphere, Mr. Hughes, by a study of agricultural colleges in Britain and elsewhere was able to formulate sound policies for Agricultural education in this State.

His successor, the present Principal (Mr. W. Southern) paid a warm tribute to the work of Mr. Hughes. His death, at a time when World War II was becoming very real to Australia, meant that any ideas of a suitable memorial had to be held in abeyance, and, even since the war, those responsible for erecting the gateway had encountered many difficulties. Its completion, said Mr. Southern, had only been possible through an example of that teamwork which Mr. Hughes had always advocated. Mr. Southern then called upon Mrs. Hughes to perform the opening ceremony by severing ribbons stretched across the gateway.

The gateway, which was designed by Mr. Marshall Clifton, embodies two massive pillars each carrying a bronze tablet. One is inscribed:—

"Hughes Memorial Gateway
Erected to the Memory of Hugh

Mrs. Hughes cutting the ribbons.

Jason Hughes, Foundation Principal of Muresk Agricultural College 1926-1938."

The other reads:—

"Muresk Agricultural College was opened on October 30th 1926 for the Extension of Agricultural Education to the People of Western Australia."

Flanking the pillars are two wrought iron and metal-mesh wings carrying the name of the College and the space between them has steel rails forming a stock-proof "run-through".

The Hughes Memorial Gateway

AERIAL SPRAYING OF CROPS

Three firms in Western Australia are now operating aircraft for the aerial spraying of weeds in crops with 2,4-D or hormone-like weedkiller, and officers of the Weeds and Seeds Branch of the Department of Agriculture have assisted these firms with the calibration of their machines and have also been associated with the initial spraying operations.

Calibration involves firstly ascertaining the effective spraying width of the boom at the height the plane is to be flown over the crop and secondly the rate the solution is sprayed from the boom. From these figures along with the ground speed of the plane the volume applied per acre can be estimated. Water is then added to the amount of weedkilling chemical required per acre to make up to that volume.

The need for accuracy in these estimations is stressed by the fact that in most cases less than two gallons of solution is being applied per acre and the average amount of active chemical is six ounces per acre.

Although aerial spraying lacks some of the precision of the more orthodox land boom unit it has the advantage of not being delayed by boggy paddocks and is a more speedly operation. The capacity of the tank fitted to the Tiger Moth plane is 35 gallons and more than 500 acres have been sprayed during one day.

It is likely that at least 50,000 acres of crop will be sprayed from the air during the present season to supplement the large area that is being treated by ground units. At this stage the results with both wild radish and wild turnip are very encouraging.

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MANUFACTURERS OF THE FAMOUS **DENNIS** CIRCULAR **POWER SAWS**

EVICTING BEES FROM HOUSES

By A. KESSELL, Junior Technician Apicultural Branch

EVERY year, the Apicultural Branch receives a number of inquiries from harassed householders concerning methods of evicting bee colonies which have taken up their abode in houses. Cavity walls often provide cosy quarters for swarms seeking accommodation, while others establish themselves in chimneys, ventilators and under floors.

The quickest method of getting rid of the bees, but one which few bee-keepers care to employ, is to exterminate the colony by means of poisonous gases. At one time the fumes from burning sulphur were widely employed but this method is apt to be dangerous as the fumes are just as deadly to human beings and animals. A much better method is now available in the use of proprietary Gammexane Smoke Generators, small cylinders about an inch high and three-quarters of an inch in diameter. When lighted these give off a dense smoke which, although not poisonous to humans, is deadly to insects. The smoke leaves a deposit of Gammexane on surfaces with which it comes into contact and this remains lethal for some time, killing any insects which settle on it.

METHOD OF USE

Seal off all entrances to the hives except one, to prevent the bees and smoke from escaping. In the case of bees which have taken up their abode in a chimney, place a flat piece of asbestos-cement sheeting over the top of the chimney so that the bees and smoke cannot escape. Also have on hand some material to block up the hole through which the generator will be inserted. The generator is lit by holding it at an angle of 45 degrees in the fingers of one hand while the match is applied to the edge. When the "smoke-bomb" begins to burn, it generates considerable heat so have a jam tin or tobacco tin handy and as soon as the generator commences to hiss and smoke appears place it in the tin and quickly push the tin through the hive entrance. Block up the entrance and allow the smoke to do its work. The bees die almost immediately except the flying bees which have been absent during the procedure. These bees may fly around for a couple of days but if they land on any surface which the smoke has contaminated they also will be killed.

The actual smoking of the generator only lasts a few seconds but the smoke will penetrate all the cracks and areas likely to hide bees and will clear away in about two hours.

In places where it is impossible to place the generator inside the hive the smoke bomb may be placed in a beekeeper's smoker and the smoke can be puffed into the hole.

There is little fear of ants becoming attracted to the empty hives, because the dead bees, combs and any honey in the hive will have been coated with Gammexane which will kill or repel the ants.

ALTERNATIVE METHODS

One alternative to the destruction of the swarm is to seek the aid of an experienced beekeeper who may be able to remove some bricks or timber from the wall of the floor and cut out the combs so that the swarm may be transferred to a box for subsequent establishment in a standard hive.

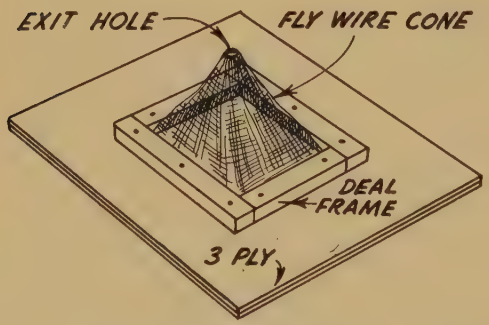

Fig. 1.—Diagram showing method of constructing the wire funnel trap

This method is not always suitable, but an experienced beekeeper may be able to apply a wire funnel trap. This method is easy and takes little time to set up; it saves all the bees and its only drawback is that it takes some time to complete the operation.

Equipment Necessary.—The operator will need beeproof clothing, a suitable veil and hat, a smoker and fuel together with hammer, nails, some short lengths of pine wood and a cone-shaped trap made from fly-wire as shown in the illustration.

The trap can be made by cutting a piece of fly-wire about 15 inches square and gradually working it into the shape of a cone. When the height of the cone is about four or five inches, tack it on to a light wooden frame, then attach the frame to a piece of three-ply with a hole about six inches square.

Fig. 2.—Hive and funnel trap in position. The trap is covering a ventilator in which the bees had established themselves

If there is more than one entrance to the hive select the one most used by the bees and block up all the remainder by nailing scraps of fly-wire over them. When all other possible entrances are blocked nail the funnel trap over the main entrance, with the cone pointing outward.

The next step is to place a ten-frame hive as close as possible to the point of the cone. The hive should contain two frames of bees with a queen and some drawn comb. If the hive has to be lifted to a high position, a block and tackle may be suspended from the roof so that the hive may be raised and lowered at will. Where this is impracticable a standard may be built on a ladder to hold the hive, or suitable supports may be fitted to hold the hives in position.

When the hive has been put in place the bees may be allowed to fly from the entrance. Using the sharpened end of

Fig. 3.—Showing method of attaching hive platform to the ladder

a pencil, a small hole is made in the point of the wire cone. This hole should be just big enough to allow a worker bee to squeeze through and fly out without too much difficulty.

Eventually all the flying bees will get out through the funnel and, not being able to return, will find their way into the set hive. There is no fear of fighting in such a case as most of the flying bees will have just returned with supplies and a bee carrying food will be accepted by any hive.

Check up to see that the bees are not getting back into the wall through another hole, then when everything is working perfectly, sit back and wait. It may take six or eight weeks before all the bees, including the newly emerged young bees, have left the wall. At a later date the queen may sometimes be seen trying to leave the wall after she has discovered that no supplies are coming in to feed the young bees and all her flying bees have failed to return. It is advisable to remove and destroy the queen if possible, thus hastening the operation.

Inspect the funnel periodically towards the end of a month and note how many bees are coming out. When no bees have been seen to come out for some time, the funnel may be removed and the bees in the hive allowed to clean out the old wall hive. They will do this readily if there is no nectar flow at the time.

Let them rob undisturbed for two to three weeks then one night close up the hive entrance and remove the hive to a place at least two miles from the old site. If the new site is less than two miles away the flying bees may be inclined to return to the wall and become a nuisance.

It is best to fit the funnel trap at the beginning of spring when most hives will be short of supplies and sending out large numbers of field bees. This means that bees will leave the wall in large numbers in a fairly short time. By the time all the bees are out of the wall the main spring flow will be nearly over and the bees will rob out the old wall hive more quickly.

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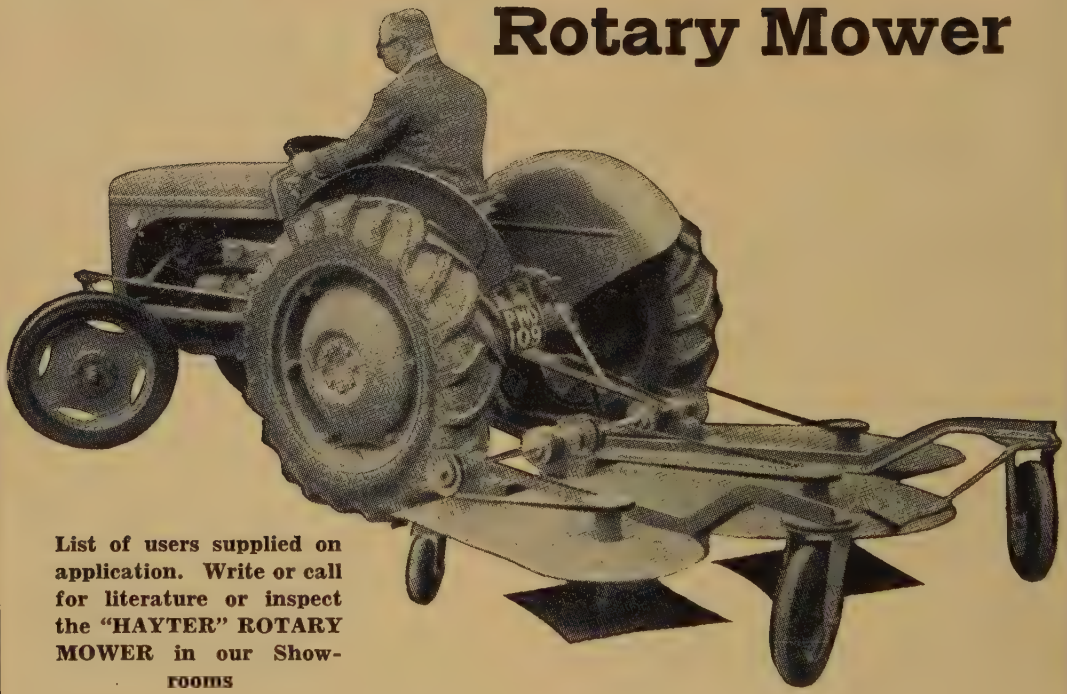

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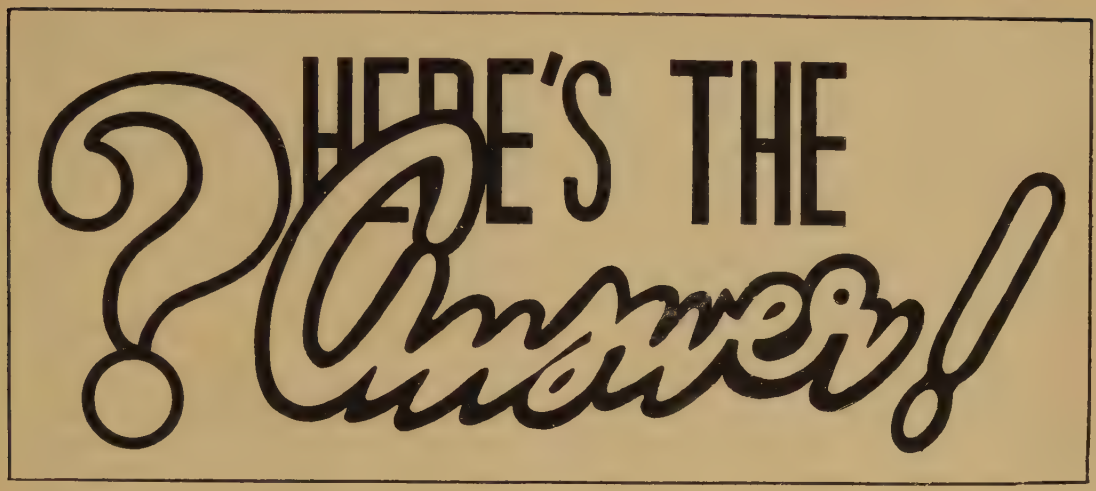

STRIKING FORTUNIANA CUTTINGS

Having read with interest the articles on roses which have appeared in the Journal I am inquiring if you can supply some advice on the rooting of Fortuniana cuttings. I have grown two Fortuniana bushes with the idea of striking some cuttings for stocks. I already have some nice roses but all are growing on briar stocks which were obtained by taking up some of the suckers.

This query was received in a letter addressed to the author of the rose articles (Mr. C. C. Hillary) but unfortunately you omitted to sign the letter.

Fortuniana cuttings are best taken from the parent bushes in May. They could also be cut during June, July and August, but the percentage of strikes is apt to be much lower than it is with cuttings taken in May.

Pieces about eight or nine inches long and about the thickness of a lead pencil usually make the best cuttings. They should be cut straight across at the bottom end, using a sharp knife, and all the leaf buds or eyes except the top one or two should be removed.

The cuttings should then be placed in bundles and "heeled in" for three-quarters of their length in clean sandy soil to callous. As soon as the cuttings have calloused they may be planted out in rows spaced three feet apart with nine inches between cuttings. It is essential that the cuttings should be watered both frequently and regularly until such time as they are growing well, and at no time during the subsequent summer should the young plants be allowed to go short of water.

CHEMICAL CONTROL OF COUCH AND KIKUYU GRASS

As an ex-dairyfarmer I am fully appreciative of the value of kikuyu grass in the right place—the pasture paddocks. My present problem is to eradicate it from a suburban quarter-acre block where I propose to build a house and establish a garden. One end is heavily infested with kikuyu grass which seems to have its root system throughout an eight-inch layer of soil. The other end of the block carries a rank growth of couch grass. Would any of the new chemicals weedicides be effective?

Both couch and kikuyu are difficult to control chemically and the best results have been obtained with sodium trichloracetate. A solution containing one pound per gallon of water should be applied in the form of a fine spray at the rate of approximately one gallon per 30 square yards.

As the chemical is absorbed largely through the roots, the grass should be cut short and the soil moist at the time of application. Ploughing or digging prior to application increases the effectiveness of the treatment. The action of the chemical is slow and a month or more may pass before maximum results are apparent. Any re-growth should be sprayed when it appears. The cost of the trichloracetate—about 8s. per lb.—restricts its usage to small areas.

Sodium chlorate, the active principle in the proprietary line, Atlacide, is also used for the control of couch and kikuyu at the same concentration and rate of application as the acetate. The chlorate is cheaper but is usually less effective, involving the spraying of a greater amount of regrowth. It is a contact spray which acts very rapidly.

Neither chemical is selective in its action and all plants on which the spray falls will be affected to a greater or lesser extent. There is also a risk of affecting shrubs and trees, including fruit trees, if spraying is carried out within the range of their root system.

The length of time for which the soil is affected by the chemicals depends on a number of factors including the rate of application, the soil type and the amount of rain or irrigation following the treatment. Sandy soils can be utilised within a month or two of moderate applications.

Unlike arsenicals, the chlorate and trichloracetate are non-poisonous to animals.

LEG MANGE OF HORSES

I have a horse with a kind of itch on the feet and legs. This itch seems to extend well up both the fore and hind legs and the animal is constantly rubbing against wire fences or against scrub. The animal is a former coalmine horse and I have been told that the trouble is "greasy heel". I rather doubt this, however, because it extends very high up the legs. Can you advise the cause and cure of this trouble?

The symptoms you have described are suggestive of leg mange. This condition results from infestation with small mites which inhabit the skin and cause considerable irritation accompanied by symptoms of stamping and rubbing.

The hind limbs are most usually affected and the parasites do not often extend beyond the level of the hock. In some cases the forelegs may also be affected, and in that case the infestation does not usually extend beyond the knees.

For the treatment of affected horses, dressing with a lime sulphur solution is recommended. Ready mixed concentrated lime sulphur may be purchased from suppliers of orchardists' requisites and the solution is prepared by mixing one part of concentrated lime sulphur with 15 parts of warm water.

Affected legs should be clipped and the clippings burnt, following upon which the dressing should be thoroughly applied in such a manner as to wet the hair right down to the skin surface. Treatment should be repeated twice weekly until recovery occurs.

BRACKEN FERN POISONING

I will be glad if you could supply me with any information dealing with the administration of Vitamin B1 in the treatment of bracken poisoning of calves and sheep. Any other information regarding this disease will also be welcome.

There has been a considerable amount of confusion over the treatment of bracken poisoning owing to uncertainty as to how the plant produced its toxic effects. However, much of the confusion has been cleared up by the finding that identical symptoms can be produced in rats and horses by Vitamin B1 (Thiamin) deficiency, and that the condition of fern poisoning can be cleared up in these animals by Vitamin B1 treatment.

With cattle, and possibly sheep, the position is not altogether clear, Vitamin B1 apparently not being successful in these animals. However, recent work in

England has indicated that Nicotinic Acid is effective in treating cattle at least. Information regarding sheep is not available, but quite probably the same thing applies in this case.

Bracken poisoning is essentially a slow process, and large amounts must be eaten to produce toxic effects. It is important to remember that deaths often continue for some weeks after animals have been removed from bracken country.

In many cases death occurs suddenly without any symptoms being shown. In others dullness, lack of appetite, and a high temperature are the usual symptoms. Condition is rapidly lost, and dark, foul-smelling dung, often containing blood, is passed. In the later stages it may be almost entirely blood.

Bleeding from the natural openings (nostrils, anus, vagina, and eyes) is common, and bleeding may also occur through the skin.

Death usually occurs within two or three days, and struggling and bellowing often precede it.

As successful treatment is still uncertain at the present time, preventative measures are important. Such things as avoidance of overstocking, the provision of adequate minerals, and where possible the eradication of bracken should be considered.

In view of the English work with Nicotinic Acid, the use of this vitamin in the treatment of cases would be warranted. Dosage was 600 mg. of Nicotinamide once daily by mouth, and in most cases successful results were obtained within three days. Treatment consequently is not expensive. Nicotinic Acid in the same dosage would probably also be successful.

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Be sure always to keep PENIJEC supplies on hand.

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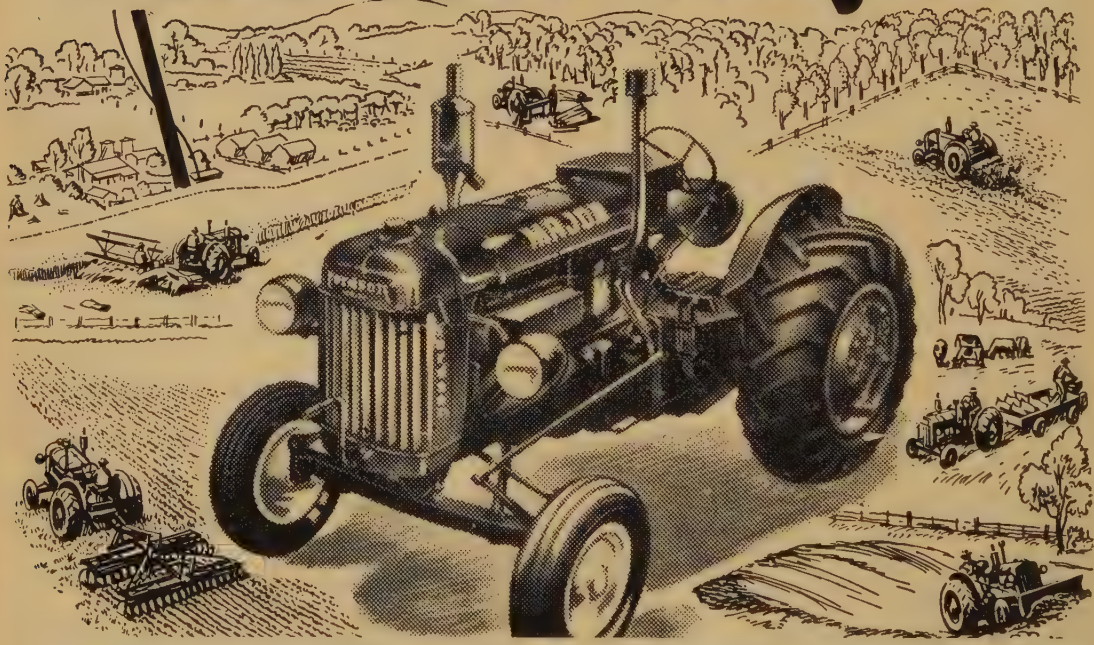

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SEASONAL REMINDERS

HORTICULTURAL NOTES FOR NOVEMBER AND DECEMBER

By OFFICERS OF THE HORTICULTURAL BRANCH

THE main cultivation of orchards and vineyards should now be completed and any further working of the soil should be restricted to the control of weed growth. Continuous cultivation of clean ground serves no useful purpose but can be very harmful by accelerating the loss of organic matter from the soil.

THINNING

The thinning of late stone fruits should be carried out before the stone sets. The earlier the thinning the more effective will be the results.

Apples should be thinned as soon as the natural drop is finished and the danger from looper caterpillars and beetles is past. Remove all misshapen and blemished fruits and leave only sufficient for the tree to bring to satisfactory size.

PESTS AND DISEASES

Apples.—November is a most important month for the control of pests in the apple orchard because of the extensive damage which can be caused by such pests as Looper Caterpillar, Climbing Cutworm and Spring Beetle at this time.

Apply a petal fall spray of—

Arsenate of Lead—3 lb.

White Oil—1¼ gallons.

Water—100 gallons.

Alternatively a 0.1 per cent. D.D.T. spray may be used effectively against many pests causing damage during this period of the year including Apple Jassid.

For Bryobia Mite use a spray of Parathion (E605) at the concentration recommended by the manufacture.

Pears.—Where necessary supplement earlier sprays for the control of Pear Scab with a petal fall spray of 2:4:50 Bordeaux mixture. It should be remembered that the Josephine and Winter Cole varieties are very subject to russetting by copper sprays. Lime Sulphur 1 in 50 can be used as an alternative.

Vines.—Vine diseases are difficult to control once established and therefore, precautionary sprays and dusts should always be applied even though there are no signs of the disease.

For Black Spot, spray before blossoming and after fruit set with 6:6:40 Bordeaux mixture. Varieties such as

Ohanez, Sultanas, and Wortley Hall are very susceptible to black spot and need special attention.

Guard against Powdery Mildew by dusting with sulphur immediately after fruit set and at regular intervals thereafter. Colloidal or wettable sulphur sprays may be used as an alternative or these materials may be incorporated in the Bordeaux spray for Black Spot.

Fruit Fly.—Regular baiting for Fruit Fly is important at this time to prevent the build up of this pest during height of the stone fruit season. All citrus and stone fruit trees carrying fruit require attention. Besides baiting gather all fallen fruit regularly and destroy by boiling or burning. Loquats should be thoroughly stripped as this fruit may provide a suitable breeding ground for the fly.

GENERAL.

The cincturing of currants should be carried out when most of the flower caps have fallen.

Remember to tuck in loose shoots which may be damaged by strong winds.

FIREBREAKS AND SOIL CONSERVATION

BY OFFICERS OF THE SOIL CONSERVATION SERVICE

THOUGH it is generally realised that ploughed firebreaks are an erosion hazard, many farmers are forced to use the plough due to the lack of other more suitable machinery or due to the presence of too much trash for a tyne implement to handle. Erosion damage is commonly caused by concentration of water down a long furrow and if this flow can be interrupted and diverted the hazard is not so great.

In order to obtain this effect, Mr. E. P. Hogben, of Wickepin, uses a novel but effective method which could well be copied by other farmers. Every four or five chains while travelling uphill, Mr. Hogben turns a complete left-hand turn (see Fig. 1); this blocks out the furrow and water is diverted out along the bottom arc of the circle, the water thus being discharged in small quantities.

If there is a steep side slope to the right, the water will run back into the furrow, so it is necessary to work the furrow as in Fig. 2.

While travelling downhill it is more difficult to design a method for producing the same result unless the plough has a suitable automatic or a screw lift. It is necessary to veer away from the fence at about 30 degrees till about 1½ chains from the fence, the plough is lifted out and after turning (see Fig. 3) the furrow is crossed while travelling in an uphill direction and the line then continues downhill.

If two cuts are made the second cut only need be worked in this manner.

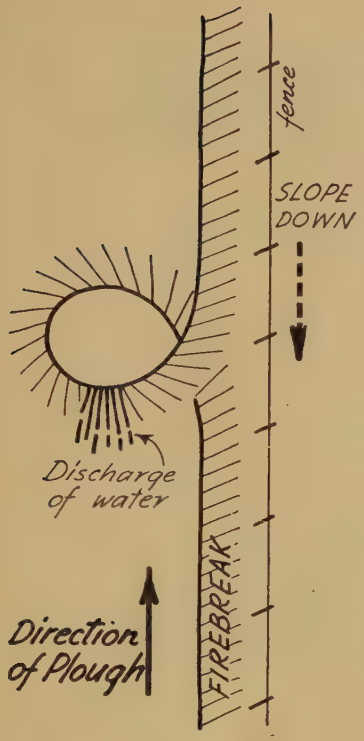

FIGURE 1.

TRAVELLING UPHILL & WITH DOWNHILL SIDE TO LEFT

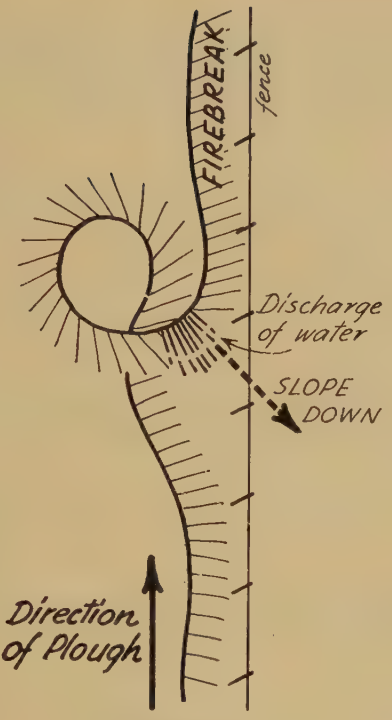

FIGURE 2.

TRAVELLING UPHILL BUT, WITH SLOPE TO THE RIGHT

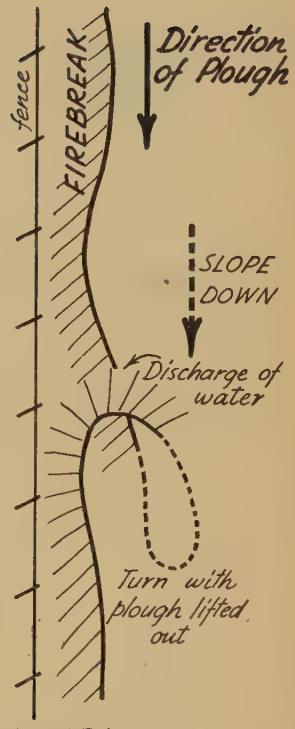

FIGURE 3.

TRAVELLING DOWNHILL

HINTS ON DIPPING

By OFFICERS OF THE VETERINARY BRANCH

NOW that shearing is in progress, sheepmen must again turn their attention to the dipping of their flocks for the control of external parasites. These will include both lice and keds, and on some properties the sheep itch mite may also need to be considered.

The choice of a dip will depend upon the kind of parasite it is desired to control and in this respect it must be remembered that a dip which is effective against one parasite will not necessarily destroy others.

The sheep body louse (Domalinia ovis) which is able to propagate under hot dry conditions has a wide distribution and occurs both in the agricultural and pastoral areas. For the control of this parasite the use of an arsenical dip is strongly recommended. A single thorough dipping in an arsenical preparation can usually be relied upon to eradicate lice from a flock. Provided

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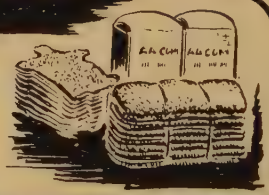

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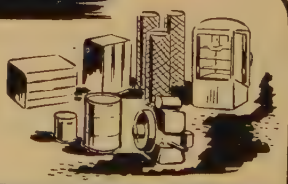

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they are used with care, the gammezane or benzene hexachloride (B.H.C.) dips are also effective for the control of body lice. They suffer, however, a disadvantage in that they tend to "strip" or become reduced in strength during use and this is most likely to occur when a small volume of dip is used for the treatment of a large number of sheep such as in a shower spray or in a dip of small capacity.

Allowance for this reduction in strength has been made by the manufacturer when calculating the amount of dip to be added to the bath to maintain the dipping fluid at an effective concentration and it is essential that the directions supplied should be strictly observed when the dip is being topped up or replenished.

CONTROL OF KEDS

The so-called sheep tick or ked (Melophagus ovinus) has a restricted distribution and is confined to the higher rainfall areas of the South-West portion of the State.

It must be emphasised that arsenical dips alone are not effective for the control of keds and that a dip containing either derris or gammexane must be employed. The use of one of the quick-acting dips which contain both arsenic and derris (these are also effective against lice) or of a "gamma"' dip is consequently recommended. When "gamma" dips are used care must be taken to compensate for stripping.

Best results will be obtained by dipping immediately after shearing since the majority of the parasites will be removed with the fleece and those that remain will be more readily destroyed by the dipping fluid while the wool is short. To avoid infection or the absorption of arsenic through open wounds, it is however advisable to delay dipping until shear cuts have healed.

The capacity of the bath should be accurately estimated and the dip added in the proportions directed by the manufacturer to ensure that it is used at the correct strength. The bath should be of sufficient length to ensure that the sheep are completely immersed and thoroughly saturated with the dipping fluid and the head of each animal should be ducked beneath the surface on two occasions as it swims through the dip. Where shower dips are employed, dipping within a month of shearing is essential and the sheep should be kept moving and retained in the spraying enclosure long enough to ensure that every portion of the fleece become thoroughly saturated. When sheep are carrying more than six weeks' wool, penetration and thorough wetting of the fleece with a shower spray is most difficult to achieve and the result of treatment is usually unsatisfactory.

All sheep on the property must be dipped at the same time since any undipped animals such as lambs, and particularly rams, will soon reinfest the flock.

DIPPING COMPULSORY

Under the Stock Diseases Act regulations, dipping for the control of keds and lice is compulsory in the South-West division of the State, in the Dundas, Esperance, Westonia and Yilgarn Road District and in those portions of the Merredin, Narambeen, Lake Grace and Phillips River Road Districts situated east of the No. 1 Rabbbit Proof Fence and is required to be completed within six weeks of the date of shearing. In addition sheep intended for sale off shears are required to be dipped prior to removal from the owners property.

In flocks affected by itch mite, complete eradication can only be achieved by dipping in a lime-sulphur solution and this should be carried out within a fortnight of shearing. Arsenical dips, while not capable of completely eradicating itch mites, will keep the parasites in check, and on properties where dipping with an arsenical preparation is practised as a regular annual routine, itch mite infestation is never likely to become a serious problem.

TOBACCO NOTES FOR NOVEMBER-DECEMBER

By T. G. HANEY, B.Sc. (Agric.)

PLANTING out should be well on the way by the first week in November and finished by the end of November. This year, two grades of fertiliser are being used. Standard fertiliser is to be used on old ground, but for newly cleared country, Tobacco fertiliser No. 2 is recommended. This contains copper and zinc, trace elements which are known to be deficient in the area.

Before transplanting, seedlings should be sprayed with a 0.1% solution of DDT. To this can be added lead arsenate at the rate of 2oz. to 3 gallons of water. This should be done after the plants have been watered prior to pulling. This mixture is also recommended for spraying in the field every ten days. A 0.2% solution could also be used if desired.

Growers should now know from experience that it is useless planting out on land which has carried a heavy clover pasture for several years. The leaf will not ripen and goes black when put into the kiln for the colouring process. This tobacco will not sell. Also, beware of planting out in swampy land. Tobacco with a high percentage of chloride has an objectionable aroma and will not burn.

It is advisable to prime off the bottom leaves when the plant reaches a height of 18 to 24 inches. This procedure allows better circulation of air around the base of the plants thus reducing the danger of blue mould attack. Also, keep sucker growth down to a minimum at the same time. Keep the crop free from weed growth.

WHEATBELT ACTIVITIES FOR NOVEMBER-DECEMBER

THE month of November should see hay-carting completed with grain harvesting commencing in the early districts. Stud seed plots for areas selected for next season's seed should be carefully harvested to avoid admixture. Order superphosphate requirements for cropping and pastures so that these will be delivered in good time for next year's operations.

Ewes for early mating should be "flushed" on good feed for three weeks prior to and during mating. A "scratched-in" crop of oats which has been used for winter grazing and allowed to recover is very suitable for flushing. Ballidu and Fulghum are good oat varieties for grazing and recovery.

At least two per cent. of rams should be used with pure Merino flocks and three per cent. for fat lamb production where a concentrated lamb is desired.

Preventive inoculation of toxic paralysis should be carried out at this time of the year if there is reason to fear an outbreak of this disease. Keep an eye on the pastures and if Wimmera rye grass is used, remember that this remains green longer than most annual species so avoid over-grazing so that this plant has an opportunity to set seed.

Most districts will complete harvesting during the month of December and it is a good idea to reserve additional supplies of seed of the early wheat varieties in case the next season opens late.

Cut straw and thatch haystacks as a good fodder reserve is well worth special attention.

This will be the main mating month especially for cross-breds. Merino and Dorset horn ewes will mate in November and other British pure breeds do not come into season until January-February.

The stubble paddocks should provide some useful grazing when harvesting operations are completed. Check fire fighting equipment so that it is ready for use if it should be needed. Carry out rabbit poisoning with phosphorus baits during the summer months.

NOVEMBER-DECEMBER POULTRY NOTES

By R. H. MORRIS, Officer in Charge, Poultry Branch

EARLY hatched chickens will be coming into the lay and following the deworming at 18 weeks of age these birds should be kept graded so that all the birds in the one pen come into production together.

Immediately the first egg is dropped, the birds should be given a laying ration which contains 16 per cent. of protein and an adequate level of calcium and phosphorus. Remember, meatmeal, whalemeal, whale solubles, bonemeal and oyster flour play an important part in poultry feeding.

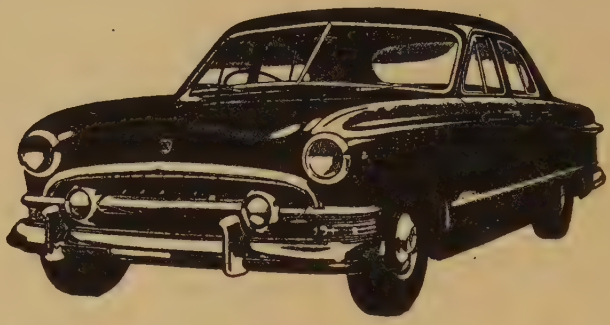
Special attention should be paid to egg quality during the summer months.

Collect eggs three times daily.

Store eggs in a cool draught-free place.

Market three times a week.

Do not under any circumstances have male birds running with females during the summer months. Small-scale producers in particular are requested to pay attention to this detail as the number of fertile eggs marketed each year is high enough to cause considerable harm to the general welfare of the industry.



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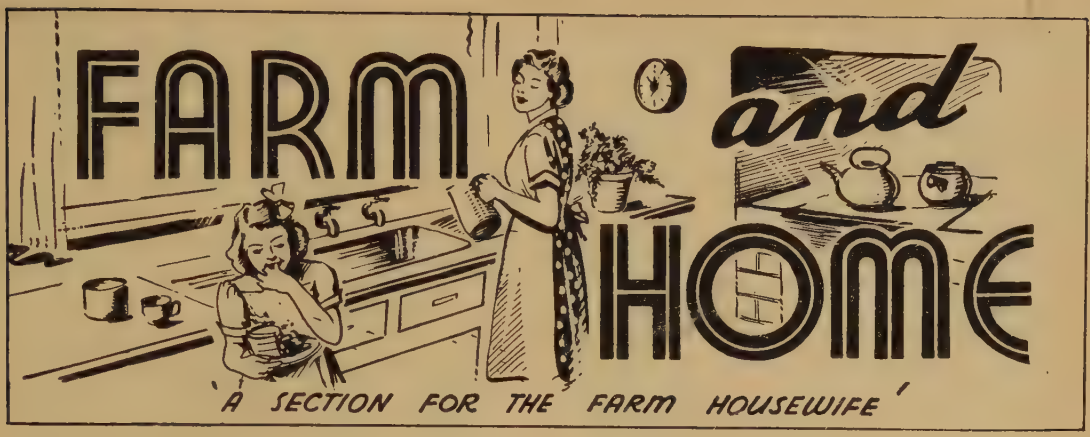

FOR BUTTER OR WORSE

By HELEN M. GLOSTER

"THE King asked the Queen, and the Queen asked the Dairymaid, 'Could we have some butter for the Royal slice of bread?'"

A. A. Milne's lines have been somewhat plaintively paraphrased in many Australian households during recent months—for as a nation we are very partial to butter and the enforced reduction of consumption has not been kindly received.

We must face facts, however. It is not my province to discuss the reasons for the current shortages in this article, but we must take cognisance of the fact that butter production has decreased and Australia's population has increased. Unless something is done to adjust the balance it would appear that our occasional seasonal shortages will soon give place to permanent butter shortages in many households.

Even when supplies are adequate, today's butter prices are apt to impose a strain on the family budget and it appears that we must accustom ourselves to eating less butter and making greater use of substitute fats.

Many other countries have been doing this for years and have evolved cheap and palatable butter substitutes which resemble butter in texture, flavour and—by the addition of vitamins—run it a close second in nutritional value.

Here in Western Australia we have yet no real rival to butter—no substitute fats to approach its palatability, its fine texture and its ease of digestion and assimilation by the normal healthy person. Regarded from the nutritional angle, butter is a valuable source of Vitamins A and D.

True, in Western Australia the average person does not have to worry about Vitamin D providing he or she gets fresh air and sunshine on most days.

There is a serious danger of Vitamin A deficiencies occurring, however, if the milk and butter intake is drastically reduced. Other edible fats are apt to be deficient in Vitamin A—a lack of which will cause eye troubles and may

lead to impaired sight or even blindness. So-called "night blindness" is soon induced if this vitamin is in short supply.

Vitamin A is also necessary to keep the mucous lining of the respiratory tract functioning satisfactorily. Ample supplies in the diet are believed to assist in preventing colds and warding off infections of the nose, throat and ears, and of the digestive and urinary tracts. Successful growth and development of children demand adequate intake of this important vitamin.

One ounce of butter a day for an adult is the minimum quantity recommended for the maintenance of good health. If the consumption falls below this level and substitute fats are used, the Vitamin A intake should be increased from other sources.

Eggs, cheese, lamb's liver, fish (especially the oily varieties such as mullet and herring) are all good sources of Vitamin A, but, if none of these is available in sufficient quantity, a daily dose of cod liver oil will be needed to supplement the diet.

Green and yellow vegetables, especially carrots, and freshly-picked lettuce, silver beet and turnip tops contain a substance called carotene which the human body can convert into Vitamin A.

When the butter ration is restricted, the available butter should be apportioned out to each member of the family and eaten on bread or toast or used in making sandwiches rather than used in cooking.

Use substitute fats in cooking, at least until we have vitamin-fortified edible fats available in Western Australia.

Lard and dripping may be used together with proprietary preparations such as margarine, Copha and White Cloud, and they all give good results if handled correctly. A few points to remember are:—

1. Use slightly less quantities of substitute fats than the recipes stipulate for butter.

2. Use extra salt for flavouring if substitute fats replace butter.

3. A little lemon juice or grated lemon rind added to cake and other mixtures will mask the flavour of dripping and lard.

4. Cakes and puddings containing substitute fats are better eaten hot than cold. Most edible fats are harder than butter and tend to make the mixtures heavy when cold.

5. Good results may often be obtained by mixtures of cooking fats such as equal quantities of lard and dripping melted together, strained and allowed to reset. Equal quantities of lard, copha and margarine will give excellent results when making flaky pastry.

RENDERING FAT

A good housewife should not need to purchase dripping if she saves the fat when preparing each day's meals. Fat scraps from the meat, pieces of suet, etc., should be cut into pieces and placed in a baking dish in a slow oven. Melted fat should be strained off and allowed to set.

Soups and stews should be carefully skimmed and the skimmings allowed to cool so that the fat may be recovered. Better still, allow soups to cool and remove the fat when it has set firmly.

When dressing poultry, keep the fat for rendering down, instead of throwing it away with the entrails. It makes an excellent substitute for butter in cakes and pastry. When boiling a fowl, save the liquid and remove the fat when cold. The liquid should then be used as the basis for soups.

Beef fat is more satisfactory than mutton fat in cooking as it is softer when cold and more readily digestible.

MARROWBONE DRIPPING

This is an excellent cooking fat for cake and pastry making—

(1) Obtain some beef marrow bones. Wash thoroughly and crack if necessary.

(2) Cover well with cold water.

(3) Simmer gently for four to five hours.

(4) Strain off liquid and allow to cool overnight.

(5) Remove fat and scrape off any meat scraps which may have adhered.

The liquid makes a foundation for delicious soups. Bones will still yield fat if boiled a second or even a third time.

HAYBOX COOKERY

By H. M. GLOSTER

IN the humble haybox we have an inexpensive form of fireless cooker which will be found ideal for the preparation of soups, stews and other dishes requiring long, gentle, even cooking. The haybox operates by retaining the heat in partly cooked pre-heated dishes, long enough for the cooking process to be completed.

The farm housewife—so often condemned to stay in an overheated kitchen when the mercury is climbing high, even in the shady spots—will find the haybox particularly useful. Food transferred to the haybox needs no further attention as it cannot burn or over-cook, so there is no need for long vigils by the hot stove.

At extra busy periods such as shearing-time and harvesting, porridge and other breakfast dishes may be prepared at night and placed in the haybox so that they will continue to cook and be available for an early breakfast. Similarly, on shopping days, a stew or boiled meat dish may be left to complete its cooking in the haybox while the family is away at the township. On their return, the meal will only need a brief "finishing off" before it is ready to serve.

In the cities and suburbs the haybox has already made many friends. It is particularly useful for working women who do their own housekeeping—and it can help to keep down fuel bills whether they be for gas, electricity or wood.

Fig. 1.—Exterior view of the haybox. It should be a stoutly-constructed wooden box with strong hinges and clasp.

TO MAKE THE HAYBOX

Obtain a stout wooden box with strong hinges and clasp. The box must be at least eight inches wider than the diameter of the saucepan or billycan that it is intended to use as a container, and should be about eight inches deeper than the depth of the container. This is to ensure that there will be at least four inches of insulating material surrounding the container in order to retain the heat.

The home-made haybox shown in the photograph measures 26in. x 17in. x 16in. and will take two containers.

Line the box, including the lid, with layers of newspapers and tack a lining of felt or flannel over the paper to keep everything in position. Old blankets or rugs which have been well laundered make excellent linings.

Now pack the bottom of the box with hay to a depth of four inches. Meadow hay or dried grass will be better for this purpose than oaten or wheaten hay which is apt to be coarse and brittle, but either kind may be used.

Fig. 2.—Interior view of box. Note thick lining of old newspapers covered with blanket cloth. There should be four inches of hay between the billy and the sides of the box and a similar hay-filled space between the billies if two are used. The hay-stuffed cushions fit on top of the billies.

Stand the container or containers on the hay, keeping them at least four inches apart if more than one are used. Pack hay firmly between and around the containers.

Make one or, preferably, two cushions stuffed with hay to place on top of the containers. They should fill all the space in the box tightly so that the lid can only be closed by applying pressure.

Fig. 3.—Porridge cooked for only five minutes and then left overnight in the haybox is cooked and ready to be served for breakfast.

RULES FOR HAYBOX COOKERY

1. All foods must be at boiling point and place in heated containers when transferred to the box.

2. The containers must have tightly-fitting lids.

3. Containers must be *filled* with the food

Fig. 4.—Apples need only to be cooked for two minutes before they are transferred to the haybox. Two hours later they will be cooked to a turn and ready to be served.

that is to be cooked. If the container is not full it will be found that the food cools rapidly and stops the cooking process before it is completed. If the container used is smaller than the space allotted, the extra space should be filled up with screwed-up paper or more hay.

4. Do not open the haybox until you are ready to take the food out.

5. Foods cooked in a haybox take about four times their normal cooking periods.

6. Food should be re-heated just before serving.

7. For large joints of meat or any food requiring a long time to cook, it may be necessary to remove the container from the box at the end of about four hours and bring the contents to the boil again before returning to the box to complete the cooking.

TIMING TABLE FOR HAYBOX COOKING

Food	Preliminary Cooking on Stove	Additional time in Haybox
Soup	45 min.	6 hours
Fish	5 min.	30 minutes
Irish Stew—		
Meat	30 min.	2½ hours
Veg.	5 min.	
Boiled Meat	45 min.	4 to 5 hours for 6lb. joint
Beef Stew	45 min.	3½ hours
Vegetables	5 min.	1½ hours
Porridge	5 min.	All night
Rice	2 min.	2 hours
Stewed Fruit	2 min.	2 hours

AN ECONOMY HINT

Instead of discarding coarse green outer leaves of lettuce when making salads, wash them thoroughly and break up roughly between the fingers. Carefully remove any discoloured portions then cook the remainder as one would cook silver beet or spinach. Serve with butter, pepper and salt as a green cooked vegetable.

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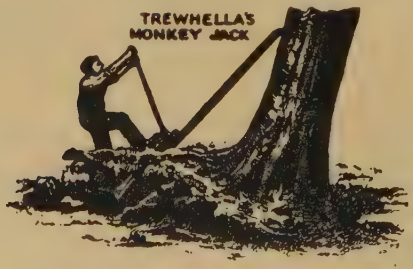


Diseases of DAIRY CATTLE

MASTITIS

By J. CRAIG, M.R.C.V.S., Senior Veterinary Surgeon

MASTITIS, or inflammation of the udder, is responsible for tremendous losses to the dairying industry throughout the world. The disease may be caused by several different types of bacteria, the most common of which, the Streptococcus, is responsible for about 80% of all cases of mastitis. The Staphylococcus is involved in about 10% of cases and the remaining 10% are caused by other micro-organisms.

These disease-causing bacteria are commonly present in nature, existing in cowsheds, yards and pastures and constantly gain entrance to the udder through the teat canal. A healthy udder can resist these mild infections, but if the natural resistance of the organ is reduced, the bacteria multiply rapidly and we soon encounter serious infections.

Faulty milking machine pressures, injuries to the udder from blows, horn thrusts, and wire cuts as well as chills from cold winds are among the many causes of lowered resistance. Once a cow has contracted a mastitis infection, the disease may be transmitted to healthy cows by the milker's hands or contaminated cloths and milking equipment.

SYMPTOMS

The first sign of infection is an alteration in the character of the milk, which may become watery, contain clots, or be tinged with blood. In some cases it is pus-like and has a most offensive odour. Depending on how severe the infection is, the udder will show heat, pain and swelling, or there may be little change. Sometimes a chronic infection will persist throughout the life of the animal, reducing milk yield and causing progressive hardening of the affected quarters. In cases of gangrenous mastitis, the quarter becomes cold and black, and may slough away, to be followed by death of the animal in many cases.

TREATMENT

In the past, the medicinal agents popular at one time or another in mastitis treatment have been many and varied, but in more recent years penicillin has proved to be of very great assistance in this respect. **Vaccines have frequently been advocated for the treatment and control of mastitis, but it is necessary in the interests of the dairyfarmer, to point out that no vaccine has yet been discovered which will either cure or prevent the disease.**

While penicillin is highly efficient against Streptococcal infection, it is considerably less so against Staphylococcal and other mastitis-producing bacteria. Penicillin is now available in the form of a suspension, which is put up in collapsible tubes fitted with a nozzle which may be inserted into the teat duct, enabling the drug to be injected direct from the tube into the affected quarter. Each tube contains 25,000 units of penicillin. The nozzle is sterilised at the time of packing, and is covered with a screw-on cap which ensures that it will remain in a sterile condition right up to the time it is required for use. Alternatively, "Mastics" may be used. These are small slender "pencils", about match-stick size, each consisting of 25,000 units of penicillin, and contained in a solid base which is soluble in milk.

Treatment consists of three injections each of 25,000 units, repeated at intervals of 24 hours for three days, and, according to convenience, they may be given after either the morning or afternoon milking. The quarter should be completely stripped out immediately prior to treatment, and the end of the teat should be cleansed by swabbing with methylated spirits before the nozzle is inserted into the teat duct. All the contents of the tube should be squeezed into the quarter, and this should be followed by massage in an upward direction to ensure that the suspension is thoroughly dispersed. The dose injected is left in the quarter until the next milking, and while the cow is under treatment the normal milking routine should not be disturbed.

Penicillin is non-irritant and does not cause any damage to the udder tissues. Should the response not be satisfactory a further course of three injections may be given. It must be recognised that Staphylococcal mastitis cannot be differentiated clinically from other forms of the disease, but in cases where doubt exists, milk samples may be submitted for laboratory examination, which will enable a definite diagnosis to be established. With Staphylococcal mastitis, 100,000 units of penicillin daily in each affected quarter may be advocated.

Sulphanilimide powder (four ounces initially, then two ounces at eight hourly intervals for 48 hours) may be given as a drench mixed with about a pint of water, and be of assistance in controlling the systemic upset seen in cases of acute mastitis; alternatively Sodium Sulphamezathine is equally useful, given in injections under the skin—dosage rate, 15 c.c. of 33⅓% solution for each 100 lb. of body weight.

Recently, much work has been carried out with the newer anti-biotics, streptomycin and aureomycin, although the latter is not as yet available for intra-mammary use in this State. The results obtained from these trials have been very encouraging, especially with regard to non-Streptococcal mastitis. Streptomycin can be obtained locally, but treatment with this drug is about three times as expensive as the use of penicillin. The technique to be employed is similar to the intra-mammary infusions described previously and consists of three injections each of 250,000 units of streptomycin in oil wax suspension. These are given at 48-hourly intervals, and have been successful in curing infections which have been resistant to penicillin therapy.

NOTE.—In connection with the intra-mammary administration of penicillin suspension, it should be noted that penicillin-treated milk affects the lactic acid forming bacteria necessary in the initial cheese making process. In view of the serious financial loss to factories from the degrading of cheese, farmers are requested to keep all milk from penicillin-treated quarters out of the factory milk supply during treatment and for at least four milkings after the last treatment.

PREVENTION AND CONTROL

Efficient milking is an important factor in the prevention of mastitis, and if the milk is withdrawn from the cow in the most efficient manner, mechanical injury to the udder is avoided. There

should be a rigid routine in the milking shed, and especially there should be no delay in starting the milking after the udders have been washed or handled in any way. The milking operation, whether by hand or by machine, should be as rapid as possible, and the degree of vacuum at which the milking machine operates should be under efficient control. This is best provided by a weighted vacuum relief valve, or by a spring loaded poppet type with covered spring. The machine should not be operated at a higher vacuum than that necessary to keep the teat cups on, and 15 inches of vacuum is recommended as the maximum. This should NOT be exceeded.

If this routine is carefully followed, the quarters will be rapidly and completely emptied, and there will be no necessity to spend time in stripping. After efficient milking there is no necessity to strip, and the small amount of milk left in some quarters will be recovered at the next milking. If left in

"STREPS" AND "STAPHS"

Many of the diseases of domesticated animals are caused by micro-organisms, tiny forms of life which are variously described by the layman as "germs", "microbes" or "bacteria". The largest of these micro-organisms would not be more than 1/25,000th of an inch in length, while the smallest are so minute that they cannot be seen, even with the aid of the highest-powered microscopes.

Streptococci and staphylococci are the types of bacteria most frequently referred to in veterinary articles. Most dairy farmers know, for instance, that about 80% of the cases of mastitis are due to "streps" and about 10% to "staphs".

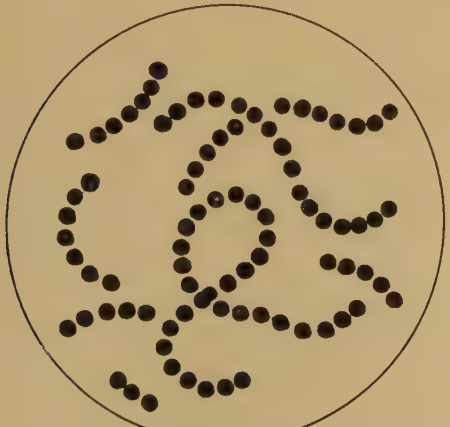
The words are derived from the Greek ("streptos"—a chain or necklace; "staphyle"—a bunch of grapes, and "coccos"—a seed or kernel).

The streptococci are small spherical bacteria which remain grouped in chain formation like strings of beads.

The staphylococci are in clusters like tiny bunches of grapes.

Other types are the diplococci in which the spherical organisms remain in pairs; bacilli, in which the organisms appear as slender rods, and spirilla in which they are wavy or curved.

The word bacteria was originally applied only to the rod-like micro-organisms but is now applied to micro-organisms as a whole, irrespective of their shapes.



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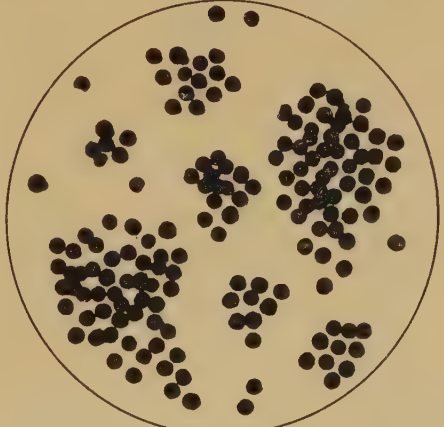

STAPHYLOCOCCI

the quarter it will do no harm. The physical violence of stripping, of unduly high vacuum, or of leaving the cups in position too long does harm, whereas leaving half a pound or more milk in the quarter does not.

If we have efficient milking, we have a sound basis on which to build a system to prevent bacterial infection of the udder in the milking shed. The sheds must be kept clean and free from dust. The aim must be to have the teats clean and sterile, and the teat cups of the machine or the hands of the milker also clean and sterile. The procedure should be as follows:—

(a) Wash the teats with warm, soapy water. Wring out the washing cloth and dry off excessive moisture.

(b) Sterilise the teats with a solution of hypochlorite. This can be made either from powder or liquid preparations on the market. The strength of the preparation is indicated by the manufacturer in terms of the available chlorine, and this should be used to prepare a solution containing at most one part of chlorine to 800 parts of water. The solution must be made fresh at each milking, and can be applied with a cloth.

(c) Place the sterilised teat cups in position as soon as possible after sterilising the teats.

(d) After milking each cow, the cups must be cleaned and sterilised. To clean, plunge them into a bucket of warm water containing washing soda (one heaped dessertspoonful to each gallon) and raise and lower them two or three times. Shake off the water and plunge the cups into a bucket of hypochlorite solution, holding them in this for ten to twenty seconds.

The early recognition of disease in the udder is important, and a careful watch should be kept on every quarter at each milking. Slight signs of inflammation can be detected easily enough if looked for. If a quarter is swollen and feels hot, this is usually an indication of infection. Sometimes there are no signs of heat or swelling in the quarter, but the milk is altered or contains clots.

These clots can be detected most easily by passing the first few streams of milk through a fine wire gauze, or a so-called "strip cup." The use of the strip cup is strongly recommended, and the test should be used on every cow once daily if possible.

Any cows showing signs of mastitis should be taken out of the line and milked last in addition to recommended treatment, and any cows purchased should be healthy and free from mastitis.

Calves and pregnant heifers should be kept as far away as possible from the milking herd. When a cow is coming to the end of a lactation period, and a decision is reached to dry off a cow, cut down the food intake, then cease milking altogether, and turn her out. Do not practice irregular milking to dry off a cow. Calves should be dehorned so as to lesson the injuries caused to udders by cows horning one another.

SUMMARY

It must be emphasised that no matter what promise treatment may offer, it must be regarded as a supplementary measure, and as a second line of defence. Prevention must remain the primary consideration, and unless precautions are taken to prevent infection by the use of hypochlorite solution in the strength required for the disinfection of teat cups and udders, by the provision of adequate facilities for the sterilisation of dairy utensils, by the maintenance of cowsheds, floors and fittings in a thoroughly clean and hygienic condition, and by the adoption of a rapid and efficient milking, it will not be possible even with the aid of penicillin and other anti-biotics to control the disease.

INTERNAL PARASITES OF CATTLE

A Common Cause of Mortality in the South-West

By J. CRAIG, M.R.C.V.S., Senior Veterinary Surgeon.

WORM infestation (Parasitic Gastro-Enteritis) is frequently a cause of serious economic loss both in calves and yearlings. It is unfortunate, however, that stock owners do not realise until too late the full extent of the effects of these worm parasites—for the cost can be counted not only in the actual deaths sustained, but in the resultant check in the animal's growth and development.

Recent investigations of mortalities in young stock in the South-West of the State have focussed attention on some of the internal parasites of cattle. The parasites we are concerned with and those which exert the most severe effects are commonly and collectively termed "hair worms," and include the following species:—

Small Brown Stomach Worm *(Ostertagia ostertagi)*

Stomach Hair Worm *(Trichostongylus axei)*

Small Intestinal Hair Worms *(Trichostrongylus spp. and Cooperia spp.)*

Calves are most susceptible to worm infestation, while young cattle up to the age of 18 months may become affected as well. Such infestation usually occurs following autumn rains, and symptoms are most commonly seen during the late autumn, winter, and early spring. However, evidence of infestation may be seen at any time of the year, especially when a falling off in the standard of nutrition takes place.

WHAT ARE THE SYMPTOMS OF PARASITISM?

The most common symptom is a progressive loss of condition. This, however, is often overlooked especially if the disease occurs at a time of the year when the animals are subsisting on a poor diet incapable of maintaining body weight. In addition, diarrhoea generally becomes a noticeable symptom. In severely affected animals, this loss of condition proceeds to the point of emaciation, but before this stage is reached, the coat becomes dry and harsh, and the animal has a dejected, hide-bound appearance. The animal usually continues to feed until a very late stage in the disease when weakness becomes so marked that when driven, the animal may stumble and fall to the ground, and for a time be unable to rise.

The diagnosis of the disease depends firstly upon the appearance of the symptoms described, in several members of a group of young cattle; and secondly on a post-mortem examination of affected stock, and the consequent identification of the parasites. A third method of diagnosis, which provides contributary evidence, involves what is known as the egg counting technique, in which a microscopical examination is made of selected samples of the droppings from one or more members of the affected group.

LIFE HISTORY

Many kinds of worms are capable of infesting cattle and causing disease. The "hair worms" belong to the nema-

todes, or round worm group, and their life cycle is as follows:—

The female worm lays her eggs, which are passed out in the dung. Under suitable conditions of temperature and moisture, the egg hatches to give rise to a tiny larval worm. During this free-living stage the larva moults twice, and is then capable of infecting cattle. This "infective larva," as it is called, crawls up the blades of grass, is eaten by the grazing animal, and so reaches maturity again in the digestive tract of the host animal.

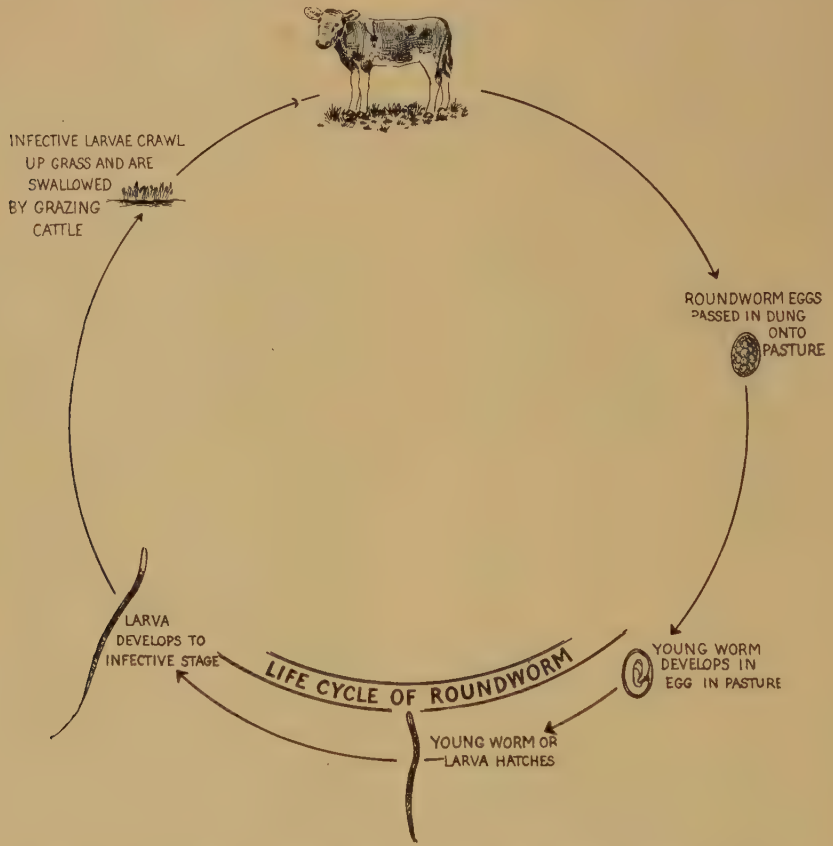
INFECTIVE LARVAE CRAWL UP GRASS AND ARE SWALLOWED BY GRAZING CATTLE
ROUNDWORM EGGS PASSED IN DUNG ONTO PASTURE
YOUNG WORM DEVELOPS IN EGG IN PASTURE
YOUNG WORM OR LARVA HATCHES
LARVA DEVELOPS TO INFECTIVE STAGE
LIFE CYCLE OF ROUNDWORM

Fig. 1.—Life cycle of Round Worm, showing how cattle become infested.

Small Brown Stomach Worm *(Ostertagia ostertagi).*

These are slender brownish worms about half an inch in length which are found in the abomasum (fourth stomach). They are generally most numerous near the opening of the stomach into the small intestine, but owing to their small size, may easily be overlooked. These parasites are most readily seen by scraping the stomach wall and examining the scrapings in a glass dish held over a dark background.

These parasites are probably the most dangerous of all the "hair worm" species mentioned. Following ingestion, the infective larvae penetrate into the walls of the stomach and lie coiled up in small nodular areas. The lining of the stomach becomes inflamed, and shows small pinpoint haemorrhages. The larvae soon leave the nodules, and complete their development to maturity in the mucosa. These worms suck blood and heavy infestations lead to emacia-

tion, anaemia, diarrhoea, and death, particularly in young stock. It is essentially a parasite of the cooler areas, and wet periods during every winter may lead to heavy infestations with these "hair worms" and consequent mortalities.

Fig. 2.—Small Brown Stomach Worm (Ostertagia ostertagi), natural size.

Stomach Hair Worm *(Trichostrongylus axei).*

These are extremely slender, reddish, hair-like worms which rarely attain a length of more than a quarter of an inch. They are found in the fourth stomach in the same situation as the Small Brown Stomach Worms. Because of their small size they are easily missed and should be looked for in light scrapings from the walls of the stomach.

This is an important parasite of temperate countries. In this State it may be found in the South-West, and like the Small Brown Stomach Worm, may become important during wet winters.

Small Intestinal Hair Worms.

These parasites fall into two groups, the *Trichostrongylus spp.* and the *Cooperia spp.*

The *Trichostrongylus spp.* inhabit the first part of the small intestine, being extremely small and slender and measuring a quarter to a third of an inch in length. They may be overlooked unless careful examination is made. Their economic importance in Western Australia has not been fully determined.

Fig. 3.—Stomach Hair Worm (Trichostrongylus axei), natural size.

There is a close relationship between infestation and nutrition, *Trichostrongylosis* being seen chiefly from weaning to about two years of age, although symptoms may be manifested by older cattle if conditions have been such as to allow heavy infestation, and the pasture growth is poor. Moderate infestation may be seen in calves as young as four weeks old, while at times only certain animals in the herd may show evidence of the disease.

Symptoms include lack of development, dejected appearance, and the passage of greenish-black, liquid faeces, offensive in odour. With this scouring, condition is rapidly lost, although animals may linger for weeks in an emaciated condition before succumbing. Attention to nutrition cannot be too strongly advocated, and the practice of using permanent paddocks without taking any steps to combat infestation should be avoided.

The *Cooperia spp.* are somewhat stouter than the *Trichostrongyles,* and may be seen in intestinal wall scrapings examined in a glass dish held over a dark background. The worms have a

reddish colouration when fresh. This parasite penetrates the lining of the small intestine and sucks blood.

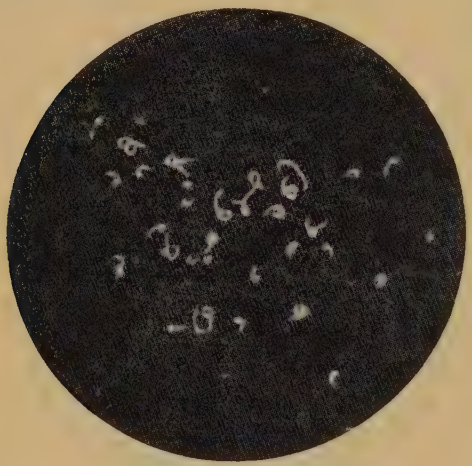

Fig. 4.—Small Intestinal Hair Worm (Cooperia spp.). Natural size

Young calves are chiefly affected, and may carry heavy infestations by the time they are three to four months old. However, this infestation is only temporary, and is usually thrown off a few months later. In general, these worms are not considered to cause disease unless present in very large numbers, such infestation being usually acquired on wet pastures. These infestations have been associated with symptoms which include marked loss of condition and diarrhoea. As with *Trichostrongyles*, more work is necessary to assess their economic importance.

TREATMENT

Since very little critical work has been done on the study of anthelmintics for cattle, the majority of the drenches used have their recommendations based on their efficiency against sheep round worms.

Generally speaking, phenothiazine is the best drug for cattle round worms as a whole, but it is known to be only moderately efficient against the smaller stomach worms *(Ostertagia spp.* and *T. axei)*, nor is it always efficient against the small intestinal worms *(Trichostrongylus spp.* and *Cooperia spp.)*.

For this reason bluestone-nicotine sulphate drenches have been commonly used against hair worms; in addition, the repeated treatments necessary tend to favour bluestone-nicotine sulphate both on account of the higher cost of phenothiazine, and its sometimes lack of availability.

Before drenching with bluestone-nicotine or phenothiazine give each animal about a quarter of a pint of a five per cent. solution of baking soda (sodium bicarbonate). This is made by dissolving 1 oz. sodium bicarbonate in a pint of water.

This closes the oesophageal groove and directs the drug into the abomasum or fourth stomach instead of allowing it to enter the rumen or paunch.

Bluestone-Nicotine Sulphate.

The solution is made as follows:—

Bluestone: 1 pound.

Commercial nicotine-sulphate, 40%: 16 fl. oz.

Water: 5 gallons.

This forms a 2% solution of both bluestone and commercial nicotine sulphate, which is administered to calves at the rate of 2 ounces per 100 lb. of body weight. The maximum dose should not exceed 4 fluid ounces. Some authorities recommend the above formula, but with the nicotine sulphate at half strength, i.e., 8 fluid ounces instead of 16 fluid ounces.

Phenothiazine.

Phenothiazine is not soluble in water, and for that reason the suspension should be kept well stirred. Starvation prior to treatment is unnecessary. The urine of treated calves is coloured red for several days following drenching. Phenothiazine should be administered at the following rates:—

2-4 months: ½ oz.

4-6 months: ¾ oz.

6-12 months: 1 oz.

12-18 months: 1½ oz.

Over 18 months: 2 oz.

An eye condition, opacity of the membrane covering the eye, sometimes follows the use of phenothiazine, but this soon disappears. The condition is a type of photo-sensitisation, and is due to the action of bright sunlight on a phenothiazine derivative present in the eye 12-36 hours after drenching. The condition may be prevented by keeping the treated animals in the shed the day after drenching.

Whether the bluestone-nicotine sulphate or phenothiazine is used, the treatment should be repeated after 14 days, and thereafter if necessary every three to four weeks. In addition, the herd should be removed from infected pastures, e.g., low lying areas which remain green and moist during the summer, and the general nutritional level improved by hand feeding or the provision of good pasture.

PREVENTION AND CONTROL

In order to put into effect logical control measures it is first necessary to know something of the life cycles of the parasites it is hoped to control.

The period spent outside the host is the weak link in the life cycle of a parasite, and everything possible should be done to prevent an animal picking up large numbers of infective larvae, and thus becoming heavily parasitised. Adult cattle are reasonably resistant to worms but calves and yearlings are more susceptible, and the latter should therefore receive primary attention when considering preventive measures.

It must be remembered that the greatest source of infestation is the small permanent calf yard, where heavy concentrations of infective larvae are built up. This is especially so when these paddocks are low-lying and damp, favouring the infective larvae which may survive several months under such conditions. Thus, frequent shifts and rotations of paddocks will allow these infective forms to die out before calves come back again to ingest these parasites. Further, it is clear that the more stock that are grazing a given area, the greater are the chances of re-infestation.

The following principles should therefore be observed to control and prevent parasitism in cattle:—

1. Confine young stock as far as possible to well-drained pastures.

2. Practise rotation of padocks, or at least arrange for periodical spelling of pastures occupied by young stock. Spelling for as short a period as one month will assist greatly in reducing pasture infestation. If it is impossible to spell, burning off may help to minimise larval forms, although the latter practice is not always practicable or desirable.

3. Avoid overstocking.

4. Supply water in suitable troughs. This is necessary because stagnant pools with some green picking around them are common sources of worm infestation.

5. Maintain a good nutritional level. This is extremely important, and cannot be over-emphasised. On weaning, a good supplementary ration should be supplied, especially where pastures are incapable of supplying an adequate standard of nutrition. A suitable lick, e.g., salt and bonemeal, and copper and cobalt in the areas where these are deficient, should be placed out separately. The best supplements consist of whole or crushed cereal grains, oats being a popular constitutent, while wheaten bran adds to the palatability of a ration, and is much used for this reason.

Commonly used supplements which may be recommended are:—

(1) Crushed or whole oaten grain.

(2) Equal parts crushed oats and crushed wheat.

(3) Equal parts crushed oats and wheaten bran.

(4) Nine parts crushed oats, three parts crushed wheat, and one part linseed meal.

Calves should be taught to eat grain as soon as possible, and by the third week should be tried with a handful of

dry grain placed in the bottom of the bucket after each animal has drunk its milk. At six weeks old the calf will eat about half a pound of grain a day; at the end of two months one pound per day and at the end of three months two pounds a day. This daily ration will be quite sufficient until the calf is six months old. It must, however, be remembered that well cured, good quality meadow hay and good pasturage are additional and necessary components in the ration, and should always be available for young growing stock.

Fig. 5.—Calves showing evidence of heavy worm infestation. Note the poor condition, harsh "staring" coat, dull eyes and dejected appearance

ALSATIAN DOGS

Because of their size, intelligence and potential ferocity, if they become sheep-killers, Alsatian dogs may not be kept in Western Australia unless they have been effectively sterilised.

The ban applies to both male and female Alsatian dogs and also to part-bred Alsatians, and the only evidence of sterilisation recognised by the Department is a certificate from a registered veterinary surgeon. Local authorities are not permitted to issue licenses for these dogs unless such a certificate is produced.

Persons having Alsatian dogs or bringing them into the State without the certificate are liable to a daily penalty of 10s. and a fine of £20, with the possibility of the dogs being destroyed.

There is ample reason for these precautions, as an Alsatian which was destroyed a few years ago in the middle of a killing spree had killed 40 sheep in one night.

BETTER DAIRYING COMPETITION, 1951-1952

By H. G. ELLIOTT, Dip. Agric., Assistant Superintendent of Dairying

THE success of the Better Dairying Competitions in previous years prompted the Western Australian Pasture Improvement Committee of the Australian Dairy Produce Board to again sponsor a similar competition during 1951-1952. The committee which receives funds from the Australian Dairy Produce Board and the Rural Credits Branch of the Commonwealth Bank, offered substantial cash prizes in the six zones as detailed below.

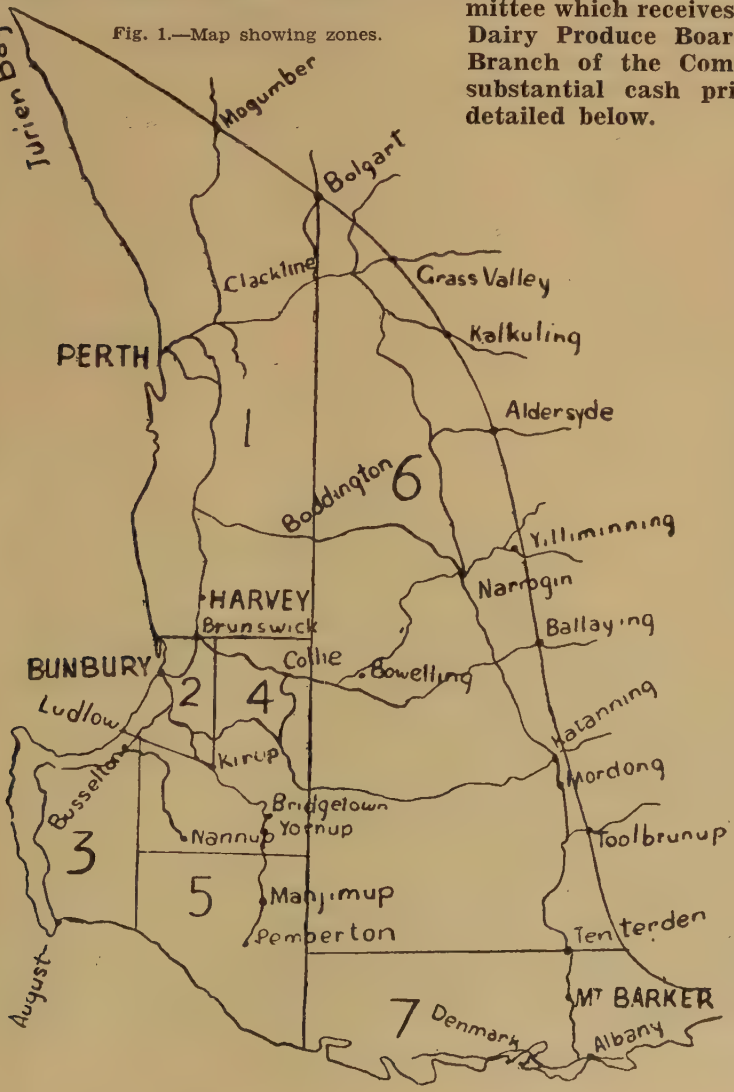

Fig. 1.—Map showing zones.

The Dairy Branch of this Department gave full support to the project by obtaining entries from farmers for the competition as well as carrying out the judging.

For the purpose of the Competition the South-West Division of the State was divided into six zones only, this being one less than previously as Zone 6 was discontinued this year. These zones are shown in the accompanying map, namely:—

1. Coastal.
2. Bunbury-Donnybrook.
3. Busselton - Margaret River.
4. Bridgetown.
5. Manjimup-Northcliffe.
7. South Coastal.

Any dairy farmer in the zone which was previously known as Zone 6 could enter the competition but was included into the zone nearest to his farm.

The prize money offered was the same as for the previous year and in each zone was as follows:—

1st prize—£20 and framed certificate.
2nd prize—£12.
3rd prize—£8.
4th prize—£6,

with a Championship Prize for the best farm in the competition, this to be in the form of a trophy to the value of £25.

The following scale of points was used in judging all zones:—

	Points.
Conservation of Fodder and Summer Crops	300
Pastures	240
Dairy Herd	120
Returns of Butter Fat, etc., per acre	120
Pigs	30
Farm Management	140
Utilisation of Skim Milk	50
	1,000

As in previous years where a competitor sold his produce as whole milk no points were allocated for the utilisation of skim milk, but the points scored were adjusted to bring the competitor on to an equal footing with the producer of cream for the manufacture of butter.

As in the previous year an account was taken of the cost of purchased foodstuffs to adjust the actual production per acre. (Section 4.—Returns of Butterfat Per Acre.)

In order to ensure as much uniformity as possible between judges and to assist the judging the scale shown was expanded within each section and these details are shown in table 1.

Entries judged in the various zones were as follows:—

Zone 1	13
Zone 2	10
Zone 3	11
Zone 4	7
Zone 5	5
Zone 7	17
Total	63

Fig. 2.—Neat entrance gate and front fence on the property of M. S. Brooking, Guildford.
Photo—Govt. Photographer.

This figure shows a reduction on the previous two years when 72 and 83 were judged, respectively. Judging in all zones was conducted in two periods, between October and January. It was necessary for the judge to visit each farm twice in order to fully appreciate annual pastures and fodder conservation, and perennial pastures and fodder crops.

Full details of points allotted to each competitor in zones are given in tables 1-6, respectively.

A handicap system operates each year on the winners of the previous season's competition and these handicaps are on the basis of—

First prize winner—deduct 15 points.
Second prize winner—deduct 10 points.
Third prize winner—deduct 5 points.
Fourth prize winner—deduct 1 point.

Press statements have been made as to the prize winners and these are also available from a perusal of tables 1 to 6, where full details of points scored by each competitor are set out.

JUDGES: K. NEEDHAM.
H. G. ELLIOTT.

TABLE 1.—BETTER DAIRYING COMPETITION, 1951-52—ZONE 1.

Details of Points Scored.

	Maximum.	M. S. Brooking.	A. Cunningham.	E. Webb.	C. W. Ward.	E. Rosher.	Marsh & Son.	T. O. Abbott.	J. Pailthorpe.	J. Murray.	F. W. Godecke.	B. Bloomfield.	A. McLoughlin.	A. Della-Franca.	D. C. Tampalini.
1. *Conservation of Fodder—*															
(a) Hay	40	32	30	35	35	34	37	38	35	35	32	35	30	35	32
(b) Silage	20	....	10	15	16	....	....	....	....	....	....	....	....	....	....
(c) Summer Fodders	20	18	12	17	12	17	....	....	....	....	20	15	15	18	16
(d) Amount per cow	200	200	200	200	200	200	50	165	132	100	122	71	100	96	37
2. *Pastures.*															
(a) Density, etc.	140	93	90	110	102	95	115	83	98	88	50	65	60	60	70
(b) Management	100	82	65	75	80	77	75	61	64	63	40	55	50	42	51
3. *Dairy Herd.*															
(a) Production	75	63	66	41	30	49	38	51	36	39	42	42	37	34	45
(b) Condition and Type	25	25	25	23	25	25	25	25	25	24	25	25	23	20	21
(c) Disease	20	19	18	18	17	19	18	17	18	19	17	17	18	17	15
(d) Herd Sire (1)	20	19	19	8	17	15	18	19	18	19	17	17	....	....	....
(2)	10	9	7	3	7	4	7	9	6	7	8	....	....	....	....
4. *Returns per Acre.*															
(a) Butterfat	100	66	68	57	40	55	52	59	45	30	42	41	57	41	51
(b) Sidelines	20	16	1	2	2	3	3	1	4	2	2	8	4	1	5
5. *Pigs.*															
(a) Breed, etc.	10	....	....	....	....	....	....	....	....	....	....	7	....	....	5
(b) Sows to cows	10	....	....	....	....	....	....	....	....	....	....	5	....	....	....
(c) Housing, etc.	10	....	....	....	....	....	....	....	....	....	....	5	....	....	5
6. *Farm Management.*															
(a) Layout	50	36	36	39	43	40	36	45	33	34	30	30	30	31	32
(b) Sanitation (1)	20	17	17	19	19	19	17	16	14	18	19	15	15	12	13
(2)	40	39	33	30	37	39	32	28	34	33	40	20	31	22	22
(c) Records	20	18	10	18	16	18	15	15	12	15	10	15	10	8	8
7. *Utilisation of Skim Milk.*	50	50	....	....	....	....	....	....	....	....	....	50	....	....	....
TOTAL	1,000	802	707	710	698	709	538	632	588	526	516	538	480	437	426
Less Handicap—Whole Milk Adjustment	....	802	739	737	735	731	566	665	619	554	543	538	505	460	448

Fig. 3.—Rear view of milking-shed of the walk-through type open front and back. (M. S. Brooking, Guildford)—Photo, Govt. Photographer

Fig. 4.—Some of M. S. Brooking's pure-bred Jersey calves.—Photo, Govt. Photographer

CHAMPIONSHIP WINNER

The State Championship Prize winner was selected from the zone winners by the Superintendent of Dairying (Mr. M. Cullity) and the chairman of the Australian Dairy Produce Board, Pasture Improvement Committee (Mr. R. H. Rose). Mr. M. S. Brooking, of Guildford, was placed first, followed by Messrs. A. and R. Poad, of Dardanup.

The following comments were made by the judges in connection with the Championship Prize:—

"Mr. Brooking has been farming a small property of 110 acres for three years only and the results achieved are extremely satisfactory. The approach to the farm, the farm buildings and general layout are attractive and the whole property gives a pleasing demonstration of modern trends in dairy farming. A good system of lane-ways serves the paddocks and all fences are in excellent condition. The farm buildings are simple but convenient and very well kept. The milk shed is airy and is fitted with tubular bails and refrigeration. The shed is powered with electricity while a jeep provides facilities for cartage and traction of farm implements. The "Nunan" irrigation system has been installed, pumping water from the Helena River, power being supplied by an electric motor. In all, 20 acres are being irrigated, four acres being under pasture and the remainder under summer crops including lucerne. Electric fences are used with satisfactory results. Strip folding of lucerne has

JUDGE: A. SHARP.

TABLE 2.—BETTER DAIRYING COMPETITION, 1951-52—ZONE 2.

Details of Points Scored.

	Maximum.	A. & R. Poad.	B. W. Brett.	J. Jarvis.	R. C. Benson.	A. C. Frost.	M. A. Crute.	P. J. Edwards.	J. & R. Roberts.	Norton Bros.	G. Palmer.
1. *Conservation of Fodder.*											
(a) Hay	40	37	35	32	25	32	30	28	32	34	....
(b) Silage	20	20	....	....	....	....	....	....	....	....	....
(c) Summer Fodders	20	18	....	14	20	....	16	....	....	....	....
(d) Amount per cow	200	187	167	200	117	164	200	96	83	60	....
2. *Pastures.*											
(a) Density, etc.	140	105	115	109	110	108	77	119	102	90	125
(b) Management	100	80	85	80	85	80	70	85	80	80	88
3. *Dairy Herd.*											
(a) Production	75	37	45	43	43	34½	25½	40	31	32	39
(b) Condition and Type	25	23	22	21	24	21	20	22	20	22	21
(c) Disease	20	19	19	20	19	17	17	18	19	17	18
(d) Herd Sire (1)	20	19	18	....	19	18	19	19	9	18	19
(2)	10	....	....	....	3	7	9	6	1	5	....
4. *Returns per Acre.*											
(a) Butterfat	100	51	73	54	100	64	18	69	43	52	53
(b) Sidelines	20	9	12	9	7	10½	12	6	16	4	2
5. *Pigs.*											
(a) Breed, etc.	10	10	9	10	10	7	8	....	9	8	....
(b) Sows to Cows	10	7	8	8	5	5	2	....	10	2	....
(c) Housing, etc.	10	9	8	10	8	8	8	....	8	7	....
6. *Farm Management.*											
(a) Layout	50	36	45	30	40	40	30	40	36	35	48
(b) Sanitation (1)	20	20	18	18	18	15	17	18	16	15	20
(2)	40	40	30	40	39	30	35	30	25	30	33
(c) Records	20	20	16	20	18	17	20	14	18	18	16
7. *Utilisation of Skim Milk*	50	32	47	42	20	12	26	....	30	32	....
TOTAL	1,000	779	772	760	730	690	659½	610	588	561	482
Less Handicap	....	779	767	760	715	690	659½	609	588	561	482

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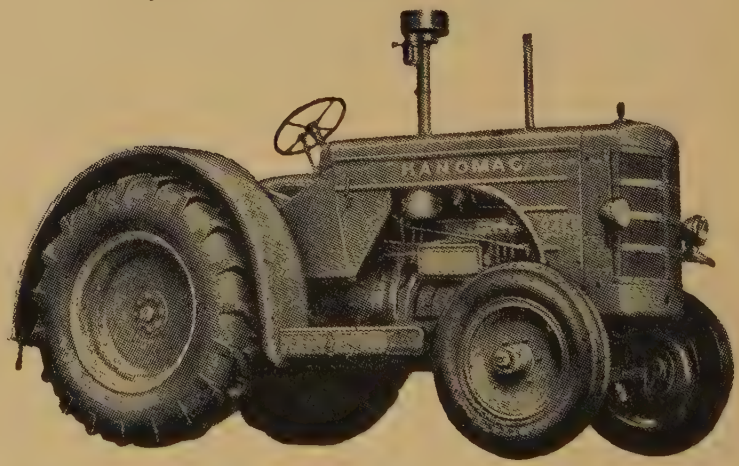

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proved an excellent method of rationing the stock and of preventing overgrazing of the plants. Drainage has been attended to wherever necessary.

"The herd is comprised mainly of pure-bred Jerseys which yielded an average 421 lb. of butterfat per head. The output per acre was 98 lb. of butterfat.

"An interesting feature of the operations of this farm was that despite the high yield, expenditure on concentrate feedstuffs was not excessive. It is Mr. Brooking's ambition to eliminate the purchase of fodder altogether and to rely completely on home grown feed supplies."

As in past competitions a wealth of valuable information was obtained by the judges during the course of the judging in this present competition, this information being of great value, not only to those farmers who competed, but also to dairy farmers in general. The farms entered in the competition may be slightly better than the general run of farms in the South-West, but from an analysis of the data, together with the judges' comments, a reasonable guide of the present position of the dairy industry in this State can be obtained, and by comparison of previous years' findings with this present year, some valuable indications of trends can be obtained.

JUDGE: P. TRAVERS-DRAPES.

TABLE 3.—BETTER DAIRYING COMPETITION, 1951-52—ZONE 3.

Details of Points Scored.

	Maximum.	J. Thompson.	H. S. Stuart.	W. D. Patmore.	C. Armstrong.	J. Oldfield.	W. Dempster.	H. Burge.	F. J. Oats.	H. J. Carter.	A. Negus.	F. Watterson.
1. *Conservation of Fodder.*												
(a) Hay	40	28	27	31	30	29	34	28	30	27	20	....
(b) Silage	20	....	....	....	....	....	....	....	....	....	....	....
(c) Summer Fodders	20	....	....	....	....	....	....	15	16	13	....	....
(d) Amount per cow	200	200	104	200	179	200	148	122	62	108	125	....
2. *Pastures.*												
(a) Density	140	111	121	104	102	102	106	114	106	63	72	123
(b) Management	100	75	80	60	60	70	58	65	65	45	45	60
3. *Dairy Herd.*												
(a) Production	75	39	48	46½	39	39	37½	37½	42	30	31·5	34½
(b) Condition and Type	25	22	23	22	22	20	21	18	21	21	20	22
(c) Freedom from Disease	20	19	19	18	19	16	18	18	18	18	17	18
(d) Herd Sire (1)	20	12	18	17	18	18	18	18	18	19	18	18
(2)	10	6	....	5		9	....	....	....	....	....	6½
4. *Returns per Acre.*												
(a) Butterfat	100	73	100	93·3	51½	66	81	92·2	56	73	63·7	70
(b) Sidelines	20	20	10½	15·3	12½	7	10	11	7	17	8	95
5. *Pigs.*												
(a) Breed, etc.	10	9	9	4	9	8	8	....	9	....	7	8
(b) Sows to Cows	10	10	10	....	8	2	8	....	8	....	5	8
(c) Housing, etc.	10	8	8	5	6	6	7	....	8	....	4	7
6. *Farm Management.*												
(a) Layout	50	36	48	34	40	45	36	47	42	40	32	40
(b) Sanitation (1)	20	15	19	14	19	18	15	19	18	17	16	16
(2)	40	25	32	25	35	30	25	38	30	30	25	35
(c) Book-keeping and Records	20	19	19	15	17	17	17	10	19	18	19	18
7. *Utilisation of Skim Milk*	50	50	50	32	50	23	50	....	32	42	44	50
TOTAL	1,000	777	746	741	717	725	698	637	607	581	572	544
Less Handicap	....	772	746	740	717	715	698	637	607	581	572	544

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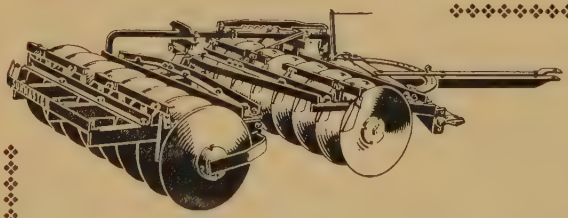

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The following discussions and comments on the various sections tend to indicate such trends as occur, and to draw attention to the results being obtained by the more efficient farmers who entered the competition.

CONSERVATION OF FODDER

General.—In the allocation of points for this section full realisation was given to the need for adequate reserves and of the 1,000 points possible, 300 are allocated for fodders and conservation and 240 for pastures. That is 54 per cent. of the maximum points are for quantity and quality of feed produced and available to stock.

It is generally considered that to maintain stock in good condition and obtain efficient economical production from them under normal climatic conditions in W.A., supplementary feeding with hay, silage and summer fodder crops is necessary for from five to six months each year.

The competition allows for a maximum of points for fodder conservation if two and a half tons of hay or its equivalent as silage or summer grazing, and crops, is conserved per dairy cow.

For the purpose of computation three tons of silage or a summer crop is equivalent to one ton of hay.

JUDGE: C. D. SHARP.

TABLE 4.—BETTER DAIRYING COMPETITION, 1951-52—ZONE 4.

Details of Points Scored.

	Maximum.	S. C. Maidment.	M. Brennan.	H. Dowerick.	H. Ellis.	J. Whitmore.	G. G. White.	S. Kelliher.
1. *Conservation of Fodder.*								
(a) Hay	40	35	29	27	27	26	35	27
(b) Silage	20	20	....	....	....	....	....	....
(c) Summer Fodders	20	....	....	....	....	....	....	....
(d) Amount per cow	200	200	104	200	150	147	80	115
2. *Pastures.*								
(a) Density, etc.	140	110	100	110	93	95	115	90
(b) Management	100	95	85	82	80	80	92	80
3. *Dairy Herd.*								
(a) Production per cow	75	37	43	28	36	38	32	13
(b) Condition and type	25	22	21	22	18	19	21	17
(c) Freedom from Disease	20	18	19	17	18	18	19	16
(d) Herd Sire (1)	20	20	18	20	17	18	18	17
(2)	10	10	10	10	10	....	8	9
4. *Returns per Acre.*								
(a) Butterfat	100	53	100	35	46	51	75	14
(b) Sidelines	20	14	20	18	10	3	3	20
5. *Pigs.*								
(a) Breed	10	7	....	....	7	7	....	5
(b) Sows to Cows	10	2	....	....	8	8	....	8
(c) Housing, etc.	10	7	....	....	6	6	....	5
6. *Farm Management.*								
(a) Layout	50	43	36	32	32	33	38	33
(b) Sanitation (1)	20	18	14	13	13	15	16	17
(2)	40	36	30	28	28	31	32	36
(c) Records	20	20	14	14	15	14	14	14
7. *Utilisation of Skim Milk*	50	24	33	16	24	22	31	28
TOTAL	1,000	791	676	672	638	631	629	564
Less Handicap	....	776	671	662	638	631	629	564

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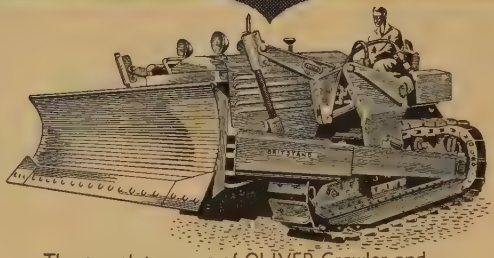

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OLIVER "FDE"	„	110
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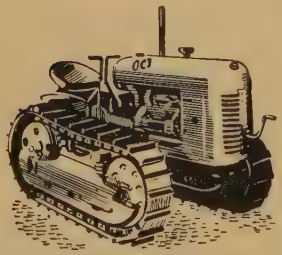
OLIVER "90"	„	42



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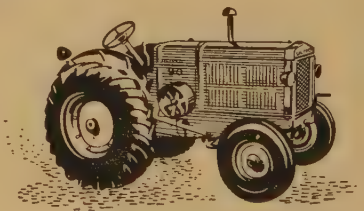

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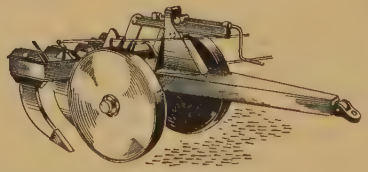

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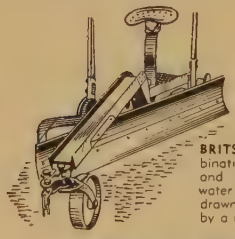

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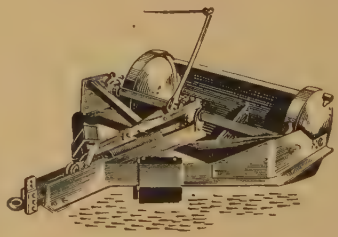

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NEED FOR FODDER RESERVES

Most annual types of pastures have reached maturity by Christmas time and from these pastures the greatest bulk of feed is produced during the spring months, consequently it is necessary on those farms where irrigation is not practised, or summer moist land not available, to provide additional feed in the form of silage or summer fodders as a succulent ration. It is well recognised that many farmers outside the whole milk zone dry off their herds for a period during the late summer, and consider that by doing so they have overcome the need for fodder conservation. This assumption on the farmers' part is not correct, as all cows should be milked through to a nine or ten months' lactation and to do this they can only continue in production if supplementary feeding is carried out during the dry months.

Allowances have to be made for dry and other stock on the farm. It is necessary to provide better than maintenance ration for all stock and, apart from that, a cow which has completed a lactation of nine to ten months and is due to calve again in two to three months needs more than a maintenance ration and should be well fed during the dry period in order to nourish the growing foetus and to replace her depleted body reserves. Most farmers realise that a cow should be forward in con-

JUDGE: J. T. McNALLY.

TABLE 5.—BETTER DAIRYING COMPETITION, 1951-52—ZONE 5.

Details of Points Scored.

	Maximum.	J. Bashford.	Della & Son.	J. C. Waugh.	E. G. Stephenson	M. Britza.
1. *Conservation of Fodder.*						
(a) Hay	40	31	26	36	25	17
(b) Silage	20	....	....	....	....	....
(c) Summer Fodders	20	....	....	....	15	....
(d) Amount per cow	200	200	200	200	103	23
2. *Pastures.*						
(a) Density	140	123	107	111	78	102
(b) Management	100	90	85	90	75	90
3. *Dairy Herd.*						
(a) Production	75	35	40	36	31	30
(b) Condition and Type	25	24	24	24	22	24
(c) Disease	20	20	18	20	20	20
(d) Herd Sire (1)	20	20	20	19	18	19
(2)	10	4	10	8	....	....
4. *Returns per Acre.*						
(a) Butterfat	100	89	83	48	34	50
(b) Sidelines	20	5	18	3	3	8
5. *Pigs.*						
(a) Breed, etc.	10	10	8	9	8	9
(b) Sows to Cows	10	9	2	2	....	9
(c) Housing, etc.	10	9	6	8	3	8
6. *Farm Management.*						
(a) Layout	50	45	30	45	42	45
(b) Sanitation (1)	20	19	17	19	18	19
(2)	40	35	25	38	37	35
(c) Records	20	20	20	20	14	20
7. *Utilisation of Skim Milk*	50	38	40	29	12	28
TOTAL	1,000	826	779	765	558	556
Less Handicap	....	811	774	765	557	556

dition during the period prior to calving so as to enable her to produce her maximum during the coming lactation.

TOTAL QUANTITY CONSERVED

Table 7 shows the average fodder conserved as hay, silage and summer crops according to each zone.

The average reserves per milking cow over all entrants in the six zones and comparisons with previous two years were—

	1949-50.	1950-51.	1951-52.
	Tons.	Tons.	Tons.
Hay	1.27	1.26	0.99
Silage	0.22	0.17	0.12
Summer Fodders	0.52	0.68	0.85
Hay Equivalent	1.52	1.54	1.33

The above figures show that for 1951-52 there was a severe decline in the tonnage of hay conserved per cow. This was probably due to the effects of the storms which occurred early in December when large tonnages of hay in the process of curing were damaged or totally ruined. With the conservation of silage, however, there is still a steady decline showing and this has been observed for the past four years. One pleasing feature, however, is the steady increase in the amount of summer fodders produced over the past three years.

Of the 63 competitors, 18 obtained maximum points for the amount of fodder conserved per cow. This compares favourably with the previous year when 16 out of 70 competitors gained maxi-

JUDGE: I. MILLER.

TABLE 6.—BETTER DAIRYING COMPETITION, 1952–52—ZONE 7.

Details of Points Scored.

	Maximum.	F. C. Smith.	F. Osborne.	S. Ravenhill.	W. Bradford.	W. Middleton.	R. Wilkinson.	J. & R. Wolfe.	C. May.	Farr Bros.	T. C. Cooper.	A. Anning.	F. Worsfold.	S. Lilford.	H. Shepherd.	J. J. Joyce.	L. Jordan.	B. J. Male.
1. *Conservation of Fodder.*																		
(a) Hay	40	37	30	30	20	30	18	32	27	26	....	34	25	32	29	....	20	....
(b) Silage	20	17	14	....	16	....	15	....	....	....	....	13	....	....	....	....	....	....
(c) Summer Fodders	20	17	....	14	14	....	....	10	14	....	....	....	14	16	....	14	....	....
(d) Amount per Cow	200	200	200	200	122	200	105½	190	170	106½	112	100	99	80	77	67	34½	....
2. *Pastures.*																		
(a) Density, etc.	140	110	86	86	82	81	98	61	83	100	82	71	56	82	72	55	63	54
(b) Management	100	90	61	76	79	81	84	58	69	90	66	65	56	61	69	58	56	54
3. *Dairy Herd.*																		
(a) Production	75	48	49	33	37½	19½	48	34	34½	36	36	37½	49½	34½	25½	33	33	22½
(b) Condition and type	25	22	22	23	25	22	24	21	21	23	23	22	22	22	22	22	23	21
(c) Disease	20	18	17	15	18	18	16	18	18	17	17	18	18	18	18	18	18	18
(d) Herd Sire (1)	20	17	16	15	17½	17	18	13	15	16	14	....	15	....	14	17	17	....
(2)	10	8	6	10	10	7	10	....	7	6	....	....	9	....	....	....	7	....
4. *Returns per Acre.*																		
(a) Butterfat	100	58	50	44	55	21	54½	48½	33½	37½	49½	63½	33	50	23	31	40	23½
(b) Sidelines	20	18	7	7½	10	3	8	10	2½	5	8	3	4	5	7	6½	3	3½
5. *Pigs.*																		
(a) Breed, etc.	10	9	8	8	8	7	8	6	8½	8	7½	8	7	8	6	7	7	....
(b) Sows to Cows	10	9½	10	10	10	6	10	....	1	5	8	2	6	6	7	2	5	....
(c) Housing, etc.	10	10	7	7	5	5	7	5	6½	6	6½	6	6	7	6	5	6	....
6. *Farm Management.*																		
(a) Layout	50	45	38	41	38	41	38	36	35	38	38	40	36	43	42	35	37	35
(b) Sanitation (1)	20	16	14	14	13	14	14	14	13	14	14	14	16	13	13	13	13	13
(2)	40	30	24	27	20	26	27	20	23	30	23	29	30	23	23	22	20	22
(c) Records	20	20	10	10	6	12	2	8	6	2	6	10	5	12	5	10	13	10
7. *Utilisation of Skim Milk.*	50	50	50	44	50	44	50	50	25	32	50	16	45	39	32	50	40	20
TOTAL	1,000	849½	719	714½	656	654½	655	634½	612½	598	560½	552	551½	551½	490½	465½	455½	296½
Less Handicap	....	834½	719	714½	656	654½	654	634½	612½	593	560½	552	551½	551½	490½	465½	455½	296½

mum points. All these farmers scored well in the other sections, particularly in production per cow and per acre.

The following farmers gained maximum points for conserved fodder and this indicated that the amount set of 2½ tons of hay or its equivalent is not excessive for in a number of cases this figure was exceeded. An example of this was the case of Mr. F. C. Smith, of Denmark, who conserved the equivalent of 3.38 tons of hay per cow.

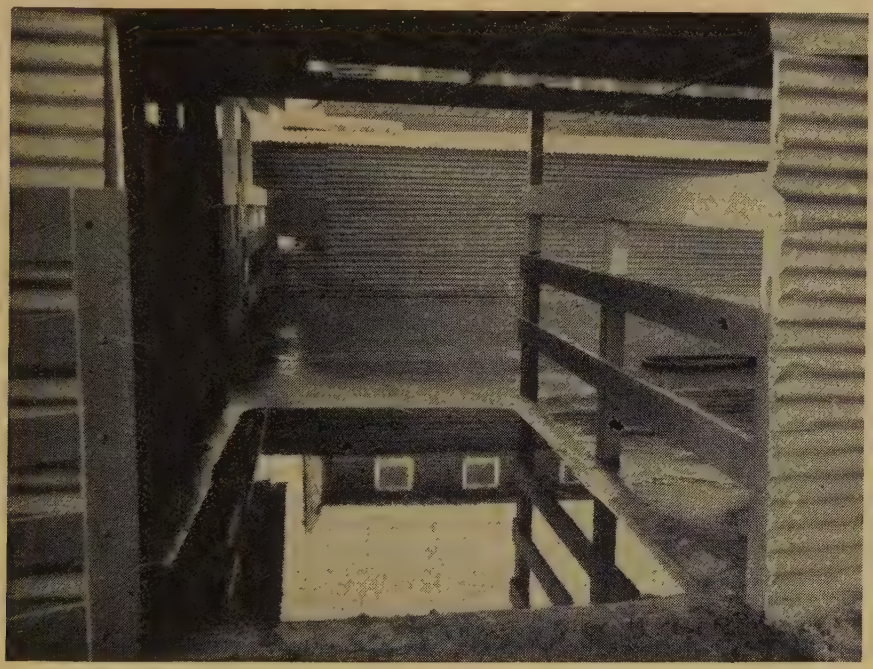

Fig. 5.—Footbath leading in to concrete holding yard. (M. S. Brooking, Guildford.)
Photo—Govt. Photographer.

TABLE 7.—FODDER RESERVES—COMPARISON OF ZONES AND WINNERS IN EACH ZONE.

	Total Cows.	Hay.	Silage.	Green Fodder.	Reserve per Cow.			Reserve per Cow. Calculated as hay.
					Hay.	Silage.	Green Fodder.	
1. *Coastal*	638	671	89	1,154½	1·05	0·14	1·81	1·70
M. S. Brooking	17·7	7	....	128	0·40	....	7·23	2·80
2. *Bunbury-Donnybrook*	370·5	306	22	246	0·82	0·06	0·66	1·07
A. & R. Poad	43	43	22	90	1·00	0·51	2·09	1·86
3. *Busselton-Margaret River*	456	517	....	231	1·13	....	0·51	1·30
J. Thompson	38·5	395	....	....	1·03	....	....	1·03
4. *Bridgetown*	267	380	90	....	1·42	0·34	....	1·53
S. C. Maidment	45	73	90	....	1·62	2·00	....	2·29
5. *Manjimup-Northcliffe*	173	176	....	72	1·02	....	0·41	1·16
J. Bashford	43	61	....	....	1·42	....	....	1·42
7. *South Coastal*	489·5	328	194	316	0·65	0·39	0·62	1·02
F. C. Smith	35·8	60	100	80	0·67	2·79	2·23	3·38
	2,394	2,378	395	2,019½	0·99	0·12	0·85	1·33

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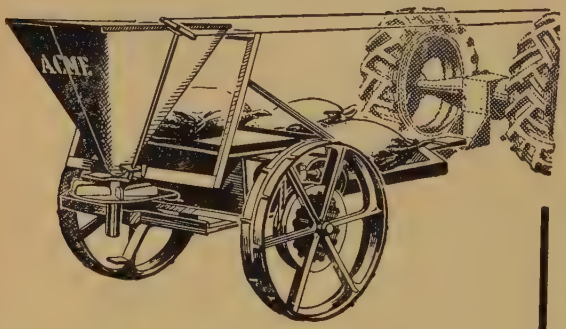

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50-54 WILLIAM ST. PERTH

Zone 1.—M. S. Brooking, of Guildford; A. Cunningham, of Armadale; E. Rosher, Bassendean; C. W. Ward, Waroona; E. Webb, Cookernup.

Zone 2.—J. Jarvis, Donnybrook; M. A. Crute, Lowden.

Zone 3.—J. Thomson, Bramley; W. D. Patmore, Warner Glen; J. Oldfield, Forest Grove.

Zone 4.—S. C. Maidment, Balingup; H. R. Dowerick, Balingup.

of the hay conserved showed the effect of weathering and in some cases moulding and blackening had occurred. The adverse conditions tended to lower the amount conserved as much of the cut material was never harvested.

It was noticeable that the trend towards greater mechanisation is still progressing and in this competition, 62 per cent., or 39 competitors, completely baled their hay.

Fig. 6.—Winter growth of lucerne. This is under sprinkler irrigation during the summer. (M. S. Brooking, Guildford.)

Photo—Govt. Photographer.

Zone 5.—D. Della & Sons, Eastbrook; J. C. Waugh, Manjimup.

Zone 7.—F. C. Smith, Denmark; F. Osborne, Denmark; E. Ravenhill, Tingledale; R. Wilkinson, Albany.

Hay.—Generally the quality of the hay conserved this year was not up to the standard of the previous two years, this being due to the adverse weather conditions which occurred in early December when the bulk of the hay was still being made. Quite a large quantity

Silage.—Conservation of silage again showed a decline on the previous year's low figure, being 0.12 tons per cow. Ten competitors, the same number as last year, conserved silage but only in comparatively small amounts. The shortage of labour and suitable machinery may be one of the major factors responsible for the small amounts made. The buck-rake, a comparatively new innovation, was used on Mr. S. C. Maidment's farm for the purpose of reducing

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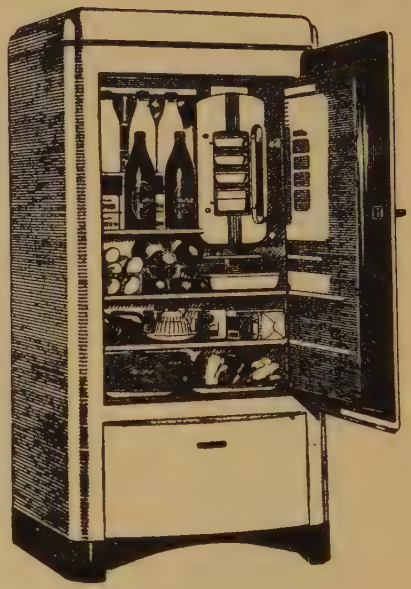

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manual labour when making silage. This implement will play a much more important part in the stimulating of silage making in the next few years as it reduces the man labour required for making this valuable fodder which ably contributes to maintaining milk production during the summer and early autumn months when most pastures are dry.

Silage, which is generally made from pastures, is a fodder which can be conserved earlier in the season than hay and under weather conditions not satisfactory for hay-making. As a general rule most of the same equipment and labour as for hay can be used to make it. Taking the above points into consideration it must be recognised that there is a reduction in the annual overhead on this class of machinery as well as the permitting a longer season for the conservation of fodder on the farm.

SUMMER FODDER CROPS

Summer fodder crops showed an increase in production over the previous year, being 0.85 tons per cow. Of the 63 competitors, 22 grew fodder crops of some kind, and the figure of 0.85 tons per cow is the highest over the last four years of the competition. This does to some degree make up for the low conservation of silage.

The table below gives the area of green fodder sown in each zone and the acreage produced per cow. Once again Zone 1 was the only zone in which the summer fodder crops reached a satisfactory level, which indicates that the farmers in the area, who are mainly whole milk producers, realise that this type of crop is important for the production of summer milk. Seven of the 14 competitors in Zone 1 grew summer fodder crops and of the remainder three conserved silage.

TABLE 8.—ACREAGE OF GREEN FODDER PER COW.

Zone.	No. of Cows.	Summer Fodder (acres)	Acres sown per cow.
1	638	118	0·185
2	370·5	29	0·078
3	456	32	0·070
4	267	....	....
5	173	20	0·116
7	489·5	19	0·039
	2,394	218	0·091

TABLE 9.—KIND AND AREAS OF GREEN FEED.

Kind of Feed.	ZONE.						TOTAL.
	1	2	3	4	5	7	
Maize	6½	1	20	....	....	13	40½
Sudan	60	9	6	....	19	....	94
Millet	33	19	3	....	1	¼	56¼
Lucerne	10	....	....	....	....	5	15
Melons, etc.	2½	....	....	....	....	¾	3¼
Sacchaline	5½	....	3	....	....	....	8½
Elephant Grass	½	....	....	....	....	....	½
	118	29	32	....	20	19	218

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The three principal green crops grown are Sudan Grass, Japanese Millet and Maize, in that order. Grazing crops such as Sudan Grass and Millet totalled 150¼ acres of the total of 218 acres of green crops sown.

Much greater attention could be given to the growing of summer fodder crops as on the average dairy farm in the South-West there is some land on which these types of crops can be grown successfully. Sudan Grass and Japanese Millet are relatively easy to grow and can be used successfully for cutting or grazing.

PASTURES

General.—The major constituent of the annual pastures in all zones is the Midseason variety of Subterranean Clover. The associated species consist of annual grasses and clovers of little value. However, introduced grasses such as Wimmera and Perennial Ryegrasses are becoming more noticeable in the pastures, while other perennial species such as Phalaris tuberosa, Kikuyu and Couch grasses are playing a more prominent part than previously to produce a larger green grazing period.

On summer moist or irrigated lands, species such as White, Strawberry and Red Clovers in association with Perennial Ryegrass, Paspalum and Cocksfoot play an important part in pasture production.

Although despised by some farmers, Kikuyu Grass is gradually being recognised by many as a valuable grazing species, giving better early and late feed, and associating well with a clover such as Subterranean. This grass will increase the carrying capacity of dairy farms if well renovated and fertilised.

Fig. 7.—View showing irrigation paddocks, layout and race.
(M. S. Brooking, Guildford.)
Photo—Govt. Photographer.

The general management of pastures is still far from perfect, insufficient attention being given to crop rotation, renovation and controlled grazing. Pasture harrowing in the early winter months to break up cow pats and aerate the soil is not practised sufficiently by farmers generally.

The fertiliser practice of competitors is very close to that recommended by the Department, as the average rate of superphosphate applied per acre is in the vicinity of one bag per annum and in most cases this is all applied in the early autumn. In those areas where

CARRYING CAPACITY

TABLE 10.—ACRES UTILISED PER MILCH COW.

Zone.	Average Number of Cows in Herd.						
	1951–52	1950–51	1949–50	1948–49	1935–36	1934–35	1933–34
1	46	56	51	51	36	41	36
2	37	35	33	34	56	29	36
3	41	41	31	33	22	23	21
4	38	32	31	36	32	22	26
5	34	38	28	43	24	21	22
7	29	26	24	26	....	20	18
Average	37·5	37·7	34·3	37·0	33·5	27·7	26·3

Zone.	Acres devoted to Dairying.						
	1951–52	1950–51	1949–50	1948–49	1935–36	1934–35	1933–34
1	158	259	234	212	172	89	124
2	155	154	136	140	213	118	245
3	184	184	154	146	100	93	91
4	183	195	157	194	154	125	134
5	129	152	133	125	86	77	85
7	152	111	105	122	....	89	55
Average	161	174·2	159·0	163·5	144·1	118·6	126·7

Zone.	Acres per Cow.						
	1951–52	1950–51	1949–50	1948–49	1935–36	1934–35	1933–34
1	3·4	4·6	4·6	4·1	4·7	4·5	3·6
2	4·2	4·4	4·1	4·1	3·8	3·8	6·8
3	4·1	4·5	5·0	4·3	4·5	4·0	6·8
4	4·8	6·0	5·0	5·3	4·8	5·4	5·3
5	3·8	4·0	4·7	3·1	3·6	3·6	4·2
7	5·3	4·2	4·4	4·7	....	4·4	3·0
Average	4·3	4·6	4·6	4·4	4·3	4·1	4·7

deficiencies occur the farmers are applying these shortages as and when required and recommended.

Table 10 shows the acres utilised per milch cow in each of the zones for all years in which competitions have been held. From these figures it will be seen that there is very little variation in the acres utilised per milch cow over the last four years.

Data collected from all farms shows the number of various classes of stock as below—

	1951-52.	1950-51.
Cows (milking or dry)	2,394	2,770
Yearlings:		
(1) Heifers	808	1,025
(2) Others	222	89
Calves:		
(1) Heifers	914	848
(2) Others	375	229
Bulls	95	90
Horses	121	149
	4,929	5,200

Table 10 gives the carrying capacity as 4.3 acres per cow, whilst the figures given above show the carrying capacity as 2.06 acres per head of all classes of stock. The figures for the previous three competitions was 2.3.

DAIRY HERDS AND PRODUCTION

Production per Cow.—Maximum points (75) were allotted to herds averaging 500 lb. butter fat per annum with a lesser number of points according to a prepared scale and furnished to the judges for herds with lower productions.

TABLE 11.—AVERAGE YIELD PER COW.

Year.	No. of Cows.	Average Yield per Cow Butterfat (lb.)
1951–52	2,394	247·5
1950–51	2,639	235·5
1949–50	2,748	237·6
1948–49	1,964	232·9
1935–36	2,109	212·0
1934–35	1,550	192·7
1933–34	1,663	208·8
1932–33	1,531	201·5

In the above table (11) the average yield per cow over all entrants is the highest on record, being 12.0 lb. higher than last year and 9.9 lb. higher than 1949-50 year, which was the record. This is a very satisfactory feature and does indicate an improvement in management and herd quality. The number of cows, however, was slightly lower than the previous two years.

TABLE 12.—AVERAGE PRODUCTION PER COW IN EACH ZONE TOGETHER WITH THAT OF THE HIGHEST PRODUCING HERD.

	1951–52.			Average Butterfat per Cow.		
	Total No. of Cows.	Average per Head.	Average butterfat per Cow.	1950–51.	1949–50.	1948–49.
1. *Coastal*	638	45·6	281·2	267·0	238·2	270·0
Cunningham, A.	....	55·7	439·0	....	....	....
2. *Bunbury-Donnybrook*	370·5	37	246·1	237·0	244·1	203·8
Brett, B.W.H.	....	40	305·0	....	....	....
3. *Busselton-Margaret River*	456	41·4	243·4	200·4	241·7	235·8
		23	315·9			
4. *Bridgetown*	267	38	207·1	214·7	231·8	220·8
Brennan, M.	....	32	289·0	....	....	....
5. *Manjimup-Northcliffe*	173	34·6	230·1	198·6	244·3	214·3
Della, D. & Son	....	34	272·0	....	....	....
7. *South Coastal*	489·5	28·8	240·5	259·5	237·6	214·0
Worsfold, F.	....	25·5	329	....	....	....
	2,394	37·4	247·5	235·5	237·6	232·9

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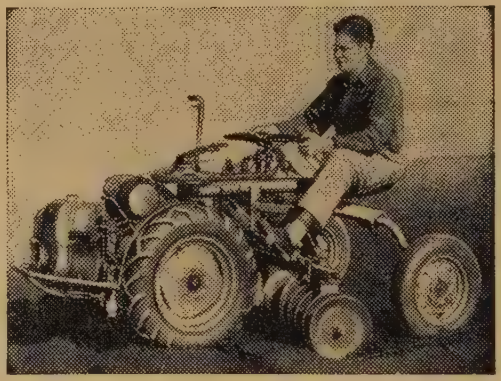

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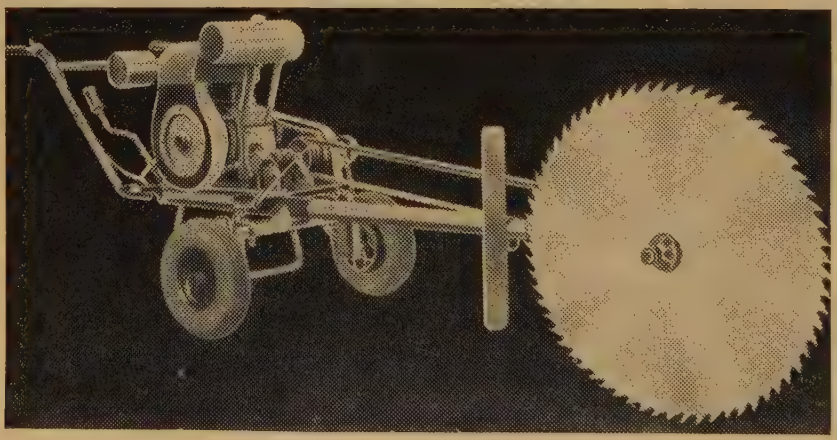

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Table 12 gives the average production per cow together with that of the highest producing (individual) herd in each zone.

Once again Mr. A. Cunningham, Armadale, in Zone 1, returned the highest yield per cow. This herd consists mainly of Friesians of which many are pure-bred animals. The milk produced is used principally for the purpose of the whole milk trade and the cows are maintained on a high level of nutrition. Mr. Cunningham received full points for fodder conservation as he conserved the equivalent of 2.7 tons of hay per milking cow.

Another high-yielding herd was that of Mr. M. S. Brooking, of Guildford, in Zone 1. This herd consists of pure-bred Jerseys which produced an average of 421 lb. of butterfat per cow, the produce being used for the table cream trade. This herd was also well provided for in the way of pastures, summer fodders and hay, together with a small area of lucerne used for both cutting and grazing.

Table 13 sets out the herds producing more than 275 lb. of fat per cow in order of merit.

In this competition, of the 16 herds with 275 lb. and over, for the first time two herds produced an average of over 400 lb. while eight produced from 300-400 lb.

It will be noticed that Mr. A. Cunningham's herd topped the list with 439 lb. and was closely followed by Mr. M. S. Brooking's herd with 421 lb. butterfat per cow with the next highest-producing herd being that of Mr. T. Abbott, of Coolup, with 336 lb.

TABLE 13.—HERDS PRODUCING MORE THAN 275 LB. BUTTERFAT PER COW 1951-52.

Owner.	Zone.	No. of Cows in herd.	Breed.	Production of butterfat per cow.
Cunningham, A. W.	1	55·7	Friesian	439
Brooking, M. S.	1	17·7	Jersey	421
Abbott, T.	1	28	Jersey	336
Worsfold, F.	7	25·5	Guernsey	329
Rosher, E.	1	69	Mixed	325
Smith, F. C.	7	35·8	Jersey	323·6
Middleton, W.	7	21·9	Jersey	319·4
Stuart, H. S.	3	23	Jersey	315·9
Patmore, W. D.	3	30	Guernsey	308·4
Brett, B. W. H.	2	40	Jersey	305
Tampolini, M.	1	55	Mixed	296
Brennan, M.	4	32	Jersey x Guernsey	289
Benson, R. C.	2	34	Jersey	286
Jarvis, J.	2	18	Jersey	286
Blomfield, B. G.	1	26·5	Guernsey	277
Oates, F. J.	3	55	A.I.S.	275

TABLE 14.—HERDS SUPPLYING WHOLE MILK ZONE 1.

Name.	No. of Cows.	Average yield (gals.)
Cunningham, A. W.	55·7	1,099·0
Rosher, E.	69	812·4
Tampolini, D. C.	55	740·7
Godecke, F. W.	70	709·5
Webb, E. M.	20	676·5
Murray, J. E.	25	643·3
McLoughlin, A.	25	633·2
Marsh, N. L. & A. N.	99	625·4
Della-Franca, A.	36	569·7
Ward, C. W.	40	499·3
	49·7	718·2

In Table 14, herds in Zone 1 supplying whole milk are tabulated showing the yield of milk in gallons. For the first time in this competition over 1,000 gallons per cow has been attained. Mr. A. Cunningham's herd produced 1,099 gallons per cow from a herd of 55.7 cows—truly a great achievement. This was 286.6 gallons higher than the next highest-producing herd, that of Mr. E. Rosher, of Bassendean. Mr. Cunningham's herd showed an increase of 205 gallons of milk per cow over last year. Mr. M. S. Brooking, who was second to Mr. Cunningham for butterfat production per cow, did not produce whole milk for sale as such and so does not appear amongst the competitors in Table 14.

The average production per cow for the whole milk suppliers of 718 gallons was 54 gallons higher than the previous year and 127 gallons over the 1949-50 competition. This is a very gratifying increase and constitutes a record for the competition as shown in Table 15.

TABLE 15.—AVERAGE YIELD OF MILK (GALS.) PER COW. COASTAL—ZONE 1.

Year.	Average Yield.
1951–52	718·6
1950–51	664·0
1949–50	591·5
1948–49	675·0
1935–36	583·0*
1934–35	540·0*
1933–34	552·0*
1932–33	414·0*

* Converted from butterfat averages as published for earlier competitions to a 4% milk.

PRODUCTION PER ACRE

Concentrates Purchased for Cows.—As in the last competition, farmers were required to make a declaration stating the amount spent on purchased fodders and concentrates fed to cows during the 12 months. The amount spent was converted into an equivalent of butterfat at 3s. 6d. per lb. and this amount of butterfat was deducted from the total butterfat production of the farm to give an estimate of the butterfat produced from pastures and home grown reserves.

TABLE 16.—CONCENTRATES PURCHASED FOR COWS.

Zone.	Average Amount per Herd.		Average Amount per Cow.	
	1951–52	1950–51	1951–52	1950–51
	£	£	£	£
1	894·6	728	19·6	12·9
2	94·3	195	2·5	5·5
3	246·1	71	5·9	1·8
4	84	104	2·2	3·2
5	164·8	220	4·8	5·7
7	155·8	109	5·4	4·1
All Zones	£316·1	£233·9	£8·4	£6·2

From the above table it will be seen that the average expenditure for all zones was higher per herd last year, being £316.1 against £233.9, and that the average amount expended per cow was higher, i.e., £8.4 per cow against £6.2.

The average amount spent on these purchased concentrates in each zone as shown in Table 16 indicates considerable variations but the highest again occurred in Zone 1, the whole milk zone, and this was considerably more than the previous year, the increase being from £12.9 to £19.6 per cow. The lowest amount spent in purchasing fodders was in Zone 4, where it amounted to only £2.2 per cow. Individual farms showed much greater variations.

Once again it must be emphasised that the large amount spent by some farmers on purchased fodders is a matter for concern. This expenditure should be regarded as a minor item in the farm budget if good dairying practices, fodder conservation, and the growing of sufficient green feed is maintained.

The higher cost per cow in Zone 1 is more or less to be expected as these herds are mainly whole milk producers and they have to maintain a high level of production during the summer

months, but apart from that aspect, higher returns are obtained for their products, making purchased feeding a comparatively economic proposition.

Table 17 gives the average production of butterfat per acre for each zone and from this it can be seen that the corrected production of butterfat per acre averaged 46.3 lb. as compared with 39.3 lb. for the previous year, which can be regarded as a great improvement. However, there is an increase in the production of butterfat per acre (uncorrected) as this rose from 51.0 lb. in 1950-51 to 57.5 lb. in 1951-52.

The figure of production per acre still appears to be rather low and this may be attributed to a number of causes, of which the following would be mainly responsible:—"Insufficient totally cleared land as much of that assessed as total area devoted to dairying includes partly cleared land and also land in the initial stages of development. Many properties are not adequately sub-divided and water supplies are not sufficient. Renovation of pastures and rotation of cropping is not a regular practice on all farms. Many other stock, including dry cows, calves and yearling bulls and horses are grazing on the area concerned."

It is thought that the average dairy farmer should give more thought to better farm and pasture management despite the shortages of labour and materials that do occur. By more efficiency in this respect the carrying capacity and production per acre of the farms could be increased.

In Table 17, acres utilised per milch cow is compared to the average production of butterfat for each zone per acre. Both the corrected and uncorrected butterfat per acre figures are shown. The average uncorrected for all zones

Fig. 8.—Liquid manure pit equipped with electric motor and pump. (E. Rosher, Bassendean.)
Photo—Govt. Photographer.

TABLE 17.—PRODUCTION PER ACRE 1950–51 AND 1951–52.

Zone.	Acres utilised per milch cow.		Average production of butterfat per acre.			
			Corrected.		Uncorrected.	
	1951–52	1950–51	1951–2	1950–1	1951–2	1950–1
1	3·46	4·6	48·9	36·8	81·3	57·8
2	4·20	4·4	56·2	45·0	59·0	53·6
3	4·44	4·5	46·9	41·5	54·5	44·2
4	4·80	6·0	40·6	31·9	43·2	35·5
5	3·74	4·0	54·3	40·3	61·5	49·9
7	5·31	4·2	39·5	41·5	45·6	61·5
	4·29	4·6	46·3	39·3	57·5	51·0

is 57.5 lb. as compared with 51.0 lb. in 1950-51, and 51.3 in 1949-50, with a range for 1951-52 of from 43.2 lb. per acre in Zone 4 to 81.3 lb. in Zone 1.

Taking into consideration the corrected butterfat production per acre it will be noted that Zone 7 has the largest area (5.31 acres) utilised per milch cow with the lowest production per acre (39.5 lb.).

In Table 18 it will be observed that the fourth place-getter in Zone 2, Mr. R. C. Benson, of Kirup, obtained 102.0 lb. of butterfat per acre after allowances had been made for purchased concentrates. This was the highest return obtained from pastures and home produced fodders by any competitor. Mr. Benson's farm, consisting of 95 acres on which he is carrying 34 cows, is a comparatively small one.

The average acreage used for dairying for all zones was slightly lower (161.0 acres) as compared with 174.2 acres for the previous year. The average number of cows per farm was practically the same, being 37.4 and 37.7, respectively, but the acres utilised per milch cow was lower this year (4.29) than the previous year (4.6).

TABLE 18.—AVERAGE PRODUCTION OF BUTTERFAT PER ACRE COMPARED WITH THAT OF THE LEADING HERD IN THIS RESPECT (CORRECTED FOR CONCENTRATES PURCHASED).

	Average Area Used for Dairying.	Average No. of Cows per Farm.	Butterfat Production per Acre.	Acres Utilised per Milch Cow.
1. *Coastal*	157·7	45·6	48·9	3·46
Cunningham, A. W.	284·0	55·7	68·2	5·10
2. *Bunbury-Donnybrook*	154·5	37·0	56·2	4·20
Benson, R. C.	95	34	102·0	2·80
3. *Busselton-Margaret River*	184·3	41·4	46·9	4·44
Stuart, H. S.	100·1	23	65·1	4·35
4. *Bridgetown*	183·0	38	40·6	4·80
Brennan, M.	92	32	87·3	2·9
5. *Manjimup-Northcliffe*	129·4	34·6	54·3	3·74
Bashford, J.	103	43	89·0	2·40
7. *South Coastal*	152·6	28·8	39·5	5·31
Anning, A.	65	20	63·6	3·25
	161·0	37·4	46·3	4·29

TABLE 19.—BREEDS OF BULLS IN HERDS.

Breed.	Zone 1.	Zone 2.	Zone 3.	Zone 4.	Zone 5.	Zone 7.	Total all Zones.
A.I.S.	8	4	8	2	1	3	26
Jersey	6	7	2	7	2	4	28
Guernsey	2	....	7	2	2	9	22
Friesian	4	....	....	....	....	....	4
Red Poll	....	....	....	....	....	1	1
Grade	6	2	1	....	....	3	12
TOTAL	26	13	18	11	5	20	93

BREED OF BULLS IN HERDS

Table 21 gives the breeds of bulls in use in the herds. It will be noticed that in this year's competition the Jerseys predominate, but are closely followed by the A.I.S. breed. There were a total of 93 bulls in the 63 herds and it was again pleasing to see a further reduction in grade bulls over last year.

UTILISATION OF SKIM MILK

As in the previous two years this section was worked out on the basis of a scale of points which gave credit to both calves and pigs fed. A maximum of 50 points was allotted in this section, where 12½ feeding months per cow were obtained based on the following schedule:—

Each porker reared, credit three feeding months.

Each calf or baconer reared, credit five feeding months.

Each slip reared, credit one feeding month.

Each weaner reared, credit one feeding month.

For each feeding month below 12½ a deduction of four points was made.

In all zones, from 2,394 cows, a total of 1,188 calves were reared and 2,439 pigs. This is 1.71 calves and pigs reared per cow, compared with 1.46 last year and 1.8 in 1949-50. Taking out the whole milk zone the figures are much better, being 2.29, which is a great improvement on last year (1.89 calves and pigs reared per cow).

TABLE 20.—UTILISATION OF SKIM MILK—NUMBER OF CALVES AND PIGS FED.

Zone.	Cows.	Calves.	Pigs (excluding Sows).	Sows.	Total Calves and Pigs	Ration Calves and Pigs to Cows
1	638	228	124	....	352	0·55
2	370·5	248	439	38	725	2·00
3	456	349	567	43	959	2·10
4	267	140	187	15	342	1·26
5	173	99	230	15	344	1·99
7	489·5	344	892	57	1,293	2·64
	2,394	1,408	2,439	168	4,015	1·71
Excluding whole milk producers	1,632	1,188	2,379	168	3,735	2·29

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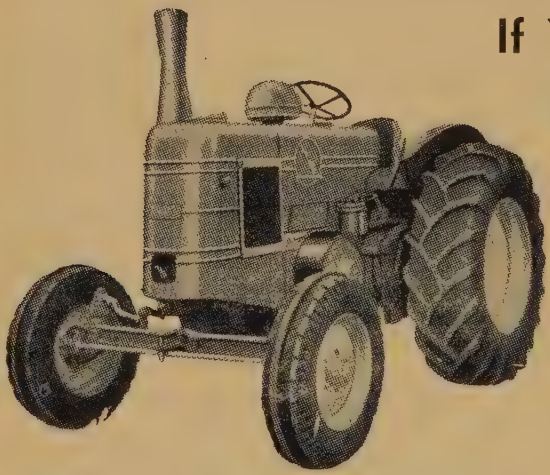

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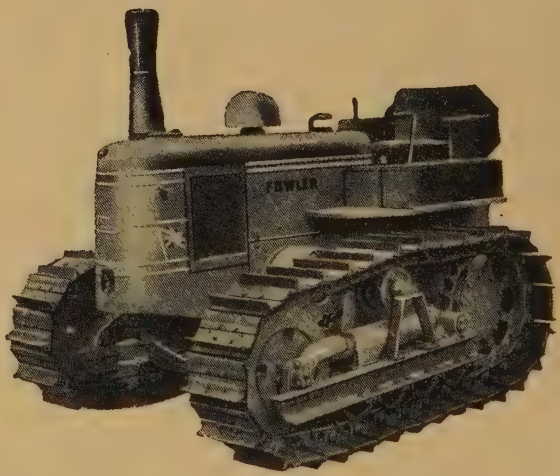

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From Table 20 it will be seen that 1,408 calves were reared from 2,394 cows; this represents slightly less than 60% of the calves born. This is an improvement on the last two years, when 40% and 50%, respectively were reared. Just under 90% of the calves reared were heifers and consequently the figures given in the table represent a rearing of 48% of heifers of the total drop of calves. It is usually regarded, under normal conditions 25% of heifers is ample to cover replacement in the herd. These replacements would be due to culling, death, sales, etc. Consequently the above figure of 48% can be regarded as extremely satisfactory.

PIG RAISING

This phase of farming on the butterfat producing property is a very profitable sideline, for the position with respect to the prices for pigmeats is so attractive and has been for the past three years.

Table 21 shows the relationship between the number of cows and the number of sows in each zone and in conjunction with Table 22 may be taken as a measure of the activity and interest in pig raising.

The number of sows in Zone 1 has always been lower than the other zones and the inclusion of these figures does not show a true picture for the butterfat areas and in Table 21 two sets of figures are shown one for all zones and one for the others, excluding Zone 1.

Excluding Zone 1 it will be seen that there were 9.7 cows per sow, this being the same as the previous year, 1950-51. Both of these years were better than the preceding two years, 11.4 and 10.3, respectively. In Table 20, it can be seen that approximately 1.5 pigs were reared per cow, which was slightly better than the previous year (1.3).

Breed of Sow.—In Table 22 breed of sow is shown and compared with the previous years.

It will be noted that the Berkshire, Tamworth and their crosses are still popular, but that there is a steady increase in the Large Whites and their crosses. The expansion with the Large Whites has been largely at the expense of the Tamworths. The Large White, in general, produces a longer side than the other breeds, and the use of the Large White in crossing with the Berkshire and Tamworth will produce a suitable bacon pig.

FARM MANAGEMENT

In this section points are allotted for the layout of the property and in particular for the convenience and type of

TABLE 21.—NUMBER OF COWS PER SOW IN ZONES.

Zone.	1951–52.		Number of Cows per Sow.			
	Total Cows.	Total Sows.	1951–52	1950–51	1949–50	1948–49
1	638	....	....	....	37·4	60·8
2	370·5	38	9·7	12·0	9·0	11·2
3	456	43	10·6	10·3	13·9	9·2
4	267	15	17·8	14·0	11·7	12·9
5	173	15	11·5	6·2	14·2	48·0
7	489·5	57	8·4	7·3	13·5	11·4
All Zones	2,394	168	14·3	13·0	15·6	17·1
Butterfat farms only	1,632	168	9·7	9·7	11·4	10·3

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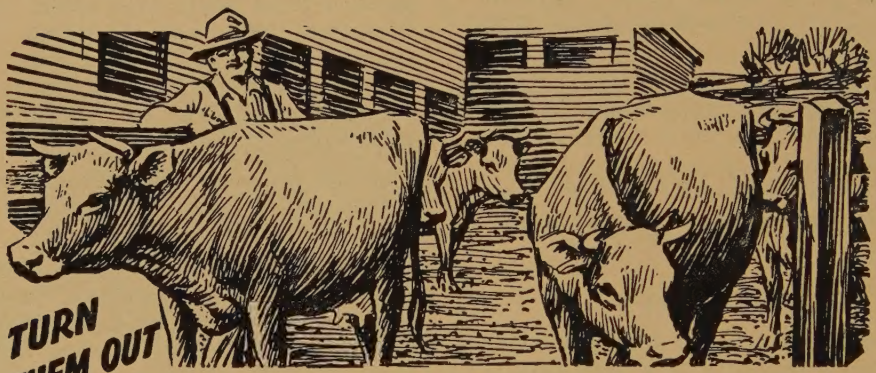

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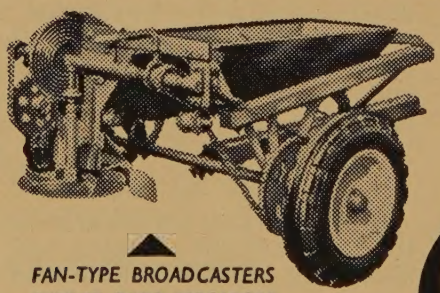

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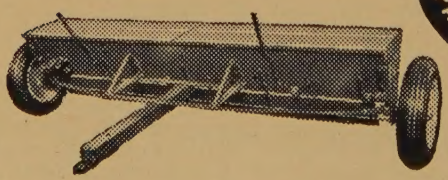

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TABLE 22.—BREED OF SOW.

Breed.	Numbers.				Percent.			
	1951–52	1950–51	1949–50	1948–49	1951–52	1950–51	1949–50	1948–49
Berkshire	59	80	65	13	35·1	39·4	38·5	12·9
Berkshire X Tamworth	24	22	30	45	14·2	10·8	17·7	44·5
Tamworth	17	16	28	14	10·0	7·9	16·5	13·9
Large White	33	28	21	11	19·9	13·8	12·4	10·9
Large White X Berkshire	15	16	14	} 18	8·9	7·9	} 14·8	17·8
Large Black	5	14	4		3·0	6·9		
Other	15	27	7		8·9	13·3		

building used for the handling of the herd and other stock and the produce. Points are also allotted for the keeping of farm records. The points gained in this section reflect on the level of management of the property.

Recent competitions point to a definite trend towards better farm layout in order to reduce the labour and make more efficient use of pastures.

Generally, the system of book-keeping is improving and this should be so as the business of dairy farming is complex and calls for accurate and complete records if efficiency is to be maintained.

SUMMARY OF DATA

	1951-2	1950-51
Number of competitors	63	70
Average size of herd (cows)	37.4	37.7
Average area of pasture per farm	161.0 acres	174.2 acres
Average area of pasture per milking cow	4.3 acres	4.6 acres
Average area per head of stock	2.06 acres	2.3 acres
Average butterfat production per cow	247.5 lb.	235.5 lb.
Average yield of butterfat per acre	57.5 lb.	51.0 lb.
Average yield of butterfat per acre corrected for concentrates fed	46.3 lb.	39.3 lb.
Fodder conserved per cow—		
Hay	0.99 tons	1.26 tons
Silage	0.12 tons	0.17 tons
Summer Crop	0.85 tons	0.63 tons
Equivalent as hay	1.33 tons	1.54 tons
Pigs—Ratio to Sows:		
All zones	14.3	13.0
Butterfat farms	9.7	9.7

Fig. 9.—Cutting oats and clover for silage on the property of A. Cunningham, Armadale.
Photo—Govt. Photographer.

SUNRISE AND SUNSET TIMES FOR NOV.-DEC., 1952

(Supplied by the Government Astronomer)

Times of sunrise and sunset for every fifth day, are given for a number of towns throughout the State. Times for a town not on the list may be estimated if its position in relation to one or more of the listed towns is known. The times given for sunrise are those of the first appearance of the top edge of the sun over a true horizon; those for sunset give the time of the sun's disappearance below a true horizon. Situation in a valley would make the sun appear to rise later, and on a hill it would appear earlier.

SUNRISE

Month.	Day of Month.	Port Hedland.	Onslow.	Carnarvon.	Yalgoo.	Geraldton.	Moora.	Kalgoorlie.	Southern Cross.	Merredin.	Perth.	Tammin.	Northam.	Narrogin.	Collie.	Bunbury.	Katanning.	Bridgetown.	Hopetoun.	Esperance.	Cape Leeuwin.	Albany.
Nov.	1	5·24	5·45	5·36	5·21	5·28	5·20	4·58	5·7	5·11	5·19	5·12	5·15	5·13	5·17	5·19	5·9	4·14	4·59	4·52	5·19	5·6
,,	5	5·23	5·34	5·35	5·19	5·26	5·17	4·55	5·4	5·8	5·17	5·10	5·13	5·10	5·14	5·16	5·7	4·12	4·57	4·50	5·17	5·3
,,	10	5·21	5·32	5·32	5·16	5·23	5·14	4·52	5·1	5·5	5·13	5·6	5·9	5·5	5·11	5·13	5·3	3·8	4·53	4·46	5·13	4·59
,,	15	5·19	5·30	5·29	5·12	5·20	5·10	4·48	4·57	5·1	5·9	5·2	5·5	5·2	5·6	5·8	4·58	3·3	4·48	4·41	5·8	4·54
,,	20	5·18	5·28	5·27	5·10	5·17	5·7	4·45	4·54	4·58	5·6	4·59	5·2	4·59	5·3	5·5	4·55	5·0	4·45	4·38	5·5	4·51
,,	25	5·17	5·27	5·26	5·9	5·16	5·6	4·44	4·53	4·57	5·5	4·58	5·1	4·57	5·1	5·3	4·53	4·58	4·43	4·36	5·3	4·49
,,	30	5·17	5·27	5·26	5·8	5·15	5·5	4·43	4·52	4·56	5·3	4·56	4·59	5·56	5·0	5·2	4·51	4·56	4·41	4·34	5·1	4·47
,,																						
Dec.	1	5·18	5·28	5·27	5·9	5·16	5·6	4·44	4·53	4·57	5·4	4·57	5·0	4·57	5·1	5·3	4·52	4·57	4·42	4·35	5·2	4·48
,,	5	5·19	5·29	5·28	5·9	5·16	5·5	4·43	4·52	4·56	5·3	4·57	5·0	4·56	5·0	5·2	4·52	4·57	4·42	4·35	5·2	4·47
,,	10	5·20	5·30	5·28	5·9	5·16	5·5	4·43	4·52	4·56	5·4	4·57	5·0	4·56	5·0	5·2	4·52	4·57	4·42	4·35	5·2	4·47
,,	15	5·21	5·31	5·29	5·10	5·17	5·6	4·44	4·53	4·57	5·5	4·58	5·1	4·57	5·1	5·3	4·53	4·58	4·43	4·36	5·3	4·48
,,	20	5·23	5·33	5·31	5·12	5·19	5·8	4·46	4·55	4·59	5·7	5·0	5·3	5·9	5·3	5·5	4·55	5·0	4·45	4·38	5·5	4·50
,,	25	5·26	5·36	5·34	5·15	5·22	5·11	4·49	4·58	5·2	5·10	5·3	5·6	5·2	5·6	5·8	4·58	5·3	4·48	4·41	5·8	4·53
,,	31	5·29	5·39	5·37	5·18	5·25	5·14	4·52	5·1	5·5	5·13	5·6	5·9	5·5	5·9	5·11	5·1	5·6	4·51	4·44	5·11	4·56

SUNSET

Month.	Day of Month.	Port Hedland.	Onslow.	Carnarvon.	Yalgoo.	Geraldton.	Moora.	Kalgoorlie.	Southern Cross.	Merredin.	Perth.	Tammin.	Northam.	Narrogin.	Collie.	Bunbury.	Katanning.	Bridgetown.	Hopetoun.	Esperance.	Cape Leeuwin.	Albany.
Nov.	1	6·15	6·32	6·40	6·32	6·43	6·39	6·17	6·26	6·30	6·42	6·35	6·38	6·38	6·42	6·44	6·38	6·43	6·28	6·21	6·48	6·37
,,	5	6·17	6·34	6·43	6·35	6·46	6·43	6·21	6·30	6·34	6·46	6·39	6·42	6·42	6·46	6·48	6·42	6·47	6·32	6·25	6·52	6·42
,,	10	6·20	6·37	6·47	6·40	6·50	6·48	6·26	6·35	6·39	6·51	6·44	6·47	6·47	6·51	6·53	6·47	6·52	6·37	6·30	6·57	6·47
,,	15	6·22	6·39	6·49	6·43	6·53	6·51	6·29	6·38	6·42	6·54	6·47	6·50	6·51	6·55	6·57	6·51	6·56	6·41	6·34	7·1	6·51
,,	20	6·25	6·43	6·53	6·47	6·58	6·56	6·34	6·43	6·47	6·59	6·52	6·55	6·56	7·0	7·2	6·56	7·1	6·46	6·39	7·6	6·56
,,	25	6·28	6·46	6·57	6·51	7·2	7·0	6·38	6·47	6·51	7·3	6·56	6·59	7·1	7·5	7·7	7·1	7·6	6·51	6·44	7·11	7·1
,,	30	6·31	6·49	7·0	6·55	7·6	7·4	6·42	6·51	6·55	7·7	7·0	7·3	7·5	7·9	7·11	7·5	7·10	6·55	6·48	7·15	7·5
,,																						
Dec.	1	6·33	6·51	7·2	6·56	7·7	7·5	6·43	6·52	6·56	7·9	7·2	7·5	7·6	7·10	7·12	7·7	7·12	6·57	6·50	7·17	7·7
,,	5	6·36	6·54	7·5	7·0	7·11	7·9	6·47	6·56	7·0	7·13	7·6	7·9	7·10	7·14	7·16	7·11	7·16	7·1	6·54	7·21	7·10
,,	10	6·39	6·57	7·8	7·3	7·14	7·13	6·51	7·0	7·4	7·16	7·9	7·12	7·14	7·18	7·20	7·14	7·19	7·4	6·57	7·24	7·15
,,	15	6·41	6·59	7·11	7·6	7·17	7·16	6·54	7·3	7·7	7·19	7·12	7·15	7·17	7·21	7·23	7·17	7·22	7·7	7·0	7·27	7·18
,,	20	6·44	7·2	7·14	7·9	7·20	7·19	6·57	7·6	7·10	7·22	7·15	7·18	7·20	7·24	7·26	7·20	7·25	7·10	7·3	7·30	7·21
,,	25	6·47	7·5	7·17	7·12	7·23	7·22	7·0	7·9	7·13	7·25	7·18	7·21	7·23	7·27	7·29	7·23	7·28	7·13	7·6	7·33	7·24
,,	31	6·48	7·6	7·18	7·13	7·24	7·23	7·1	7·10	7·14	7·26	7·19	7·22	7·24	7·28	7·30	7·24	7·29	7·14	7·7	7·34	7·25